Excavation of the INDIAN CREEK V SITE An Archaic Gathering Camp in the Maryland Coastal Plain

The Cultural Resource Group
LOUIS BERGER & ASSOCIATES, INC.

Prepared for

WALLACE ROBERTS & TODD

and

WASHINGTON METROPOLITAN AREA
TRANSIT AUTHORITY

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EXCAVATION OF THE INDIAN CREEK V SITE (18PR94) PRINCE GEORGES COUNTY, MARYLAND

FINAL REPORT

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ABSTRACT

Anticipating a 1993 construction date for the Greenbelt Storage Yard METRO railcar storage and maintenance facility, the Washington Metropolitan Area Transit Authority (WMATA) began planning activities in 1986 to consider the effects of construction on archaeological resources. After the initial archaeological survey indicated extensive prehistoric use of the 70-acre project area, WMATA sponsored a second study to evaluate the significance of the archaeological properties. This second investigation determined that one portion of the Indian Creek V Site contained well-preserved remains of a campsite occupied by aboriginal hunter-gatherer groups during the Archaic period of prehistory. The present document reports WMATA's program of archaeological data recovery at the Indian Creek Site, designed to mitigate unavoidable adverse effects to the site that will occur when construction begins.

WMATA's survey, testing and data recovery programs have provided much important new information pertaining to Archaic lifeways in the Middle Atlantic Coastal Plain region. The Indian Creek Site has been interpreted as a gathering camp/processing site that was repeatedly visited for short periods to exploit seasonally available plant resources. As a seasonally occupied gathering camp, the site was part of an annual settlement round that also included visits to the South Mountain area of Maryland and Pennsylvania as well as other loci in the Coastal Plain. The excavations focused on the recordation of features and activity areas and yielded an assemblage of some 60,000 items, a botanical assemblage of seeds and macrospores that includes 63 taxa, and a pollen core that contains a vegetation record for the terminal Pleistocene and Holocene epochs. Data analysis has focused on information needs identified in Maryland's Historic Preservation Plan, including prehistoric chronology, subsistence, settlement patterns, intrasite patterning of activities, environmental adaptation, and technology.

ACKNOWLEDGMENTS

A large number of individuals participated in this study, from its inception in mid-1986. Without their knowledge, support, and interest, the project could not have been completed successfully.

The sponsor of the project, the Washington Metropolitan Area Transit Authority (WMATA), was supportive throughout the study and provided important technical information in a timely fashion. John Patteson of the Engineering and Architecture Branch facilitated the program by providing internal coordination and liaison for WMATA. The study was conducted under the overall supervision of Wallace Roberts & Todd (WRT), WMATA's prime contractor for environmental planning. Diana Mendes of the WRT staff provided oversight and served as liaison with WMATA.

The Maryland Historical Trust (MHT) and the Division of Archeology, Maryland Geological Survey (MGS) also provided important oversight roles and responded in a timely fashion to all requests for consultation and guidance. Beth Cole and Richard Hughes represented the MHT. Under the supervision of Tyler Bastian, Dennis Curry, Lois Brown, and Maureen Kavanaugh provided important support from the MGS.

Mr. Dennis Webb, a resident of College Park, also provided invaluable assistance. As a result of his familiarity with the area's archaeological resources, he provided the first official archaeological site reports for the project area and donated a collection of artifacts to the Maryland Geological Survey. While this study was in progress, he generously shared his field notes and visited the site to provide additional information.

The Cultural Resource Group of Louis Berger & Associates, Inc. (LBA), had responsibility for the technical execution of the study. The LBA staff was under the overall supervision of John A. Hotopp, Group Vice President, and Charles LeeDecker, Principal Investigator for the project. John Martin served as Field Supervisor for the excavations, assisted by David Susice, Crew Chief, and Charles Dunton, Logistics Coordinator. The field crew members included Carrie Campbell, Keith Easley, Lisa Elsinger, Tim Gardner, Jennifer Germer, Kevin Kooistra, Yvonne McCann, Ed Miller, Robert Perales, Tom Sloss, and Mark Whitby.

Suzanne Kahn and Sharla Azizi, Laboratory Supervisors, and Marian Craig, Assistant Laboratory Supervisor, supervised the processing and cataloging of artifacts and contextual samples. They were assisted by Christine Allhstrom, Aaron Astor, Anthony Azizi, Joseph Balummal, Martha Dawson, Charles Fiaschetti, Ellis Freed, Sigrit Gabler, Rob Jacoby, Brad Koldehoff, Gary McGowan, Arthur Mason, Jill Mayo, Paul Muto, Alex Ortiz, Jim Truncer, Grigorio Sangalang, Roman Shevchuk, Byron Simmons, Ritchwell Suayan, Stacie Szewczyk, Srin Tangirala, Jim Truncer, Richard Veit, and David Wolfe. Brad Koldehoff, Lithic Material Specialist, joined the LBA staff midway through the project, and he had primary responsibility for analysis of the stone tools; with the goal of providing a consistent, error-free database, he reexamined tools and debitage from all phases of fieldwork at the site, and this effort has been of major benefit to the outcome of the study. A number of LBA's archaeologists provided helpful advice and informal assistance during the course of the project. These individuals include William Barse, John Cavallo, Jonathan Lothrop, R. Michael Stewart and Robert Wall.

Editing and production of the report was carried out by Lee Nicoletti, Production Manager, and Suzanne Szanto, Technical Editor. Linda Lipka executed the graphic production, and Rob Tucher and Tony Masso deserve much credit for the field and laboratory photography.

Some specialized studies were undertaken by consultants. Cheryl Holt of Analytical Services for Archaeologists was responsible for the flotation analysis, and Grace Brush of the Department of

Geography and Environmental Engineering, Johns Hopkins University, completed the pollen analysis. The University of Delaware Center for Archaeological Research and Paleo Research Laboratories of Golden, Colorado, conducted tests for residues on the stone tools and debitage. Daniel Wagner of Geo-Sci Consultants, Inc., conducted a study of the Indian Creek floodplain geomorphology and local pedological conditions. Other subcontractors that participated in the program include Advanced Management, Inc. (computer data entry), Construction Control Services Corp. (field crew), and Casillas Press, Inc. (printing).

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I. INTRODUCTION

The Cultural Resource Group of Louis Berger & Associates, Inc. (LBA), has conducted an archaeological data recovery program for the Indian Creek V Site (18PR94), located in Prince Georges County, Maryland. This program was sponsored by the Washington Metropolitan Area Transit Authority (WMATA) through Wallace Roberts & Todd, WMATA's consultant for environmental planning studies. As a recipient of funding from the Urban Mass Transit Administration, WMATA undertook this investigation to comply with federal cultural resource management policies that require consideration of the effects of construction on significant historic or prehistoric resources, including Section 106 of the National Historic Preservation Act of 1966, Section 101 of the National Environmental Policy Act of 1969, "Protection and Enhancement of the Cultural Environment" (Executive Order 11593), and the Procedures for the Protection of Historic and Cultural Properties, as amended (36 C.F.R. 800).

The archaeological data recovery program followed an archaeological survey and testing program (LeeDecker et al. 1988) carried out for the Greenbelt Storage Yard, a METRO railcar maintenance and storage facility that will be constructed by WMATA at the northern terminus of the E-Route (Green Line). The Greenbelt Yard facility will include a large number of storage tracks; a service, inspection, and repair shop; and an access road for vehicular traffic. The project area is located on an undeveloped tract within the Beltsville Agricultural Research Center that is bounded by the Capital Beltway (Interstate 495), the B&O Railroad, and Edmonston and Sunnyside avenues (Figures 1 and 2).

Prior to LBA's initial survey, two prehistoric sites (18PR93 and 18PR94) had been recorded by a local collector within the 70-acre project area. The initial survey was undertaken during the period from November 1986 to January 1987, and this study indicated that an extensive prehistoric lithic scatter covered nearly 50 acres of the project area, encompassing both of the previously recorded sites. For the most part, the prehistoric material associated with the site was confined to plowed and eroded contexts, but a small area of the site, designated Area 3 of Site 18PR94, was apparently well preserved. Following consultations with the Maryland Historical Trust and preparation of a management summary, a program of intensive site testing and evaluation was undertaken for Area 3. This testing program was carried out during September and October 1987.

The site testing program determined that Area 3 had been occupied throughout the Archaic period of prehistory (circa 8000 BC to 1000 BC). Although the site had been cultivated during the historic period, approximately 70 percent of the recovered assemblage was from undisturbed subsoil contexts. More important, well-preserved features and activity areas were identified during testing. The features included two lithic workshop areas and two clusters of fire-cracked rock that appear to represent cooking areas. Flotation studies indicated that the site contained a floral assemblage comprising various edible herbs, starchy seeds, tubers, and greens that were probably exploited by the aboriginal site occupants. Also, specialized tests indicated that animal residues had been preserved on a sample of the stone tools. Some vertical translocation of the prehistoric deposits was evident, but distributional studies indicated the presence of horizontally well-defined activity areas (LeeDecker et al. 1988).

Area 3 was formally determined to be eligible for inclusion in the National Register of Historic Places. The site's significance derived from its demonstrated potential to provide information concerning regional prehistory--specifically, prehistoric subsistence, technology, settlement patterning and environmental adaptations. After the site was determined eligible for the National Register, WMATA entered a formal Memorandum of Agreement with the Advisory Council on Historic Preservation, the Urban Mass Transit Administration, and the Maryland Historical Trust.

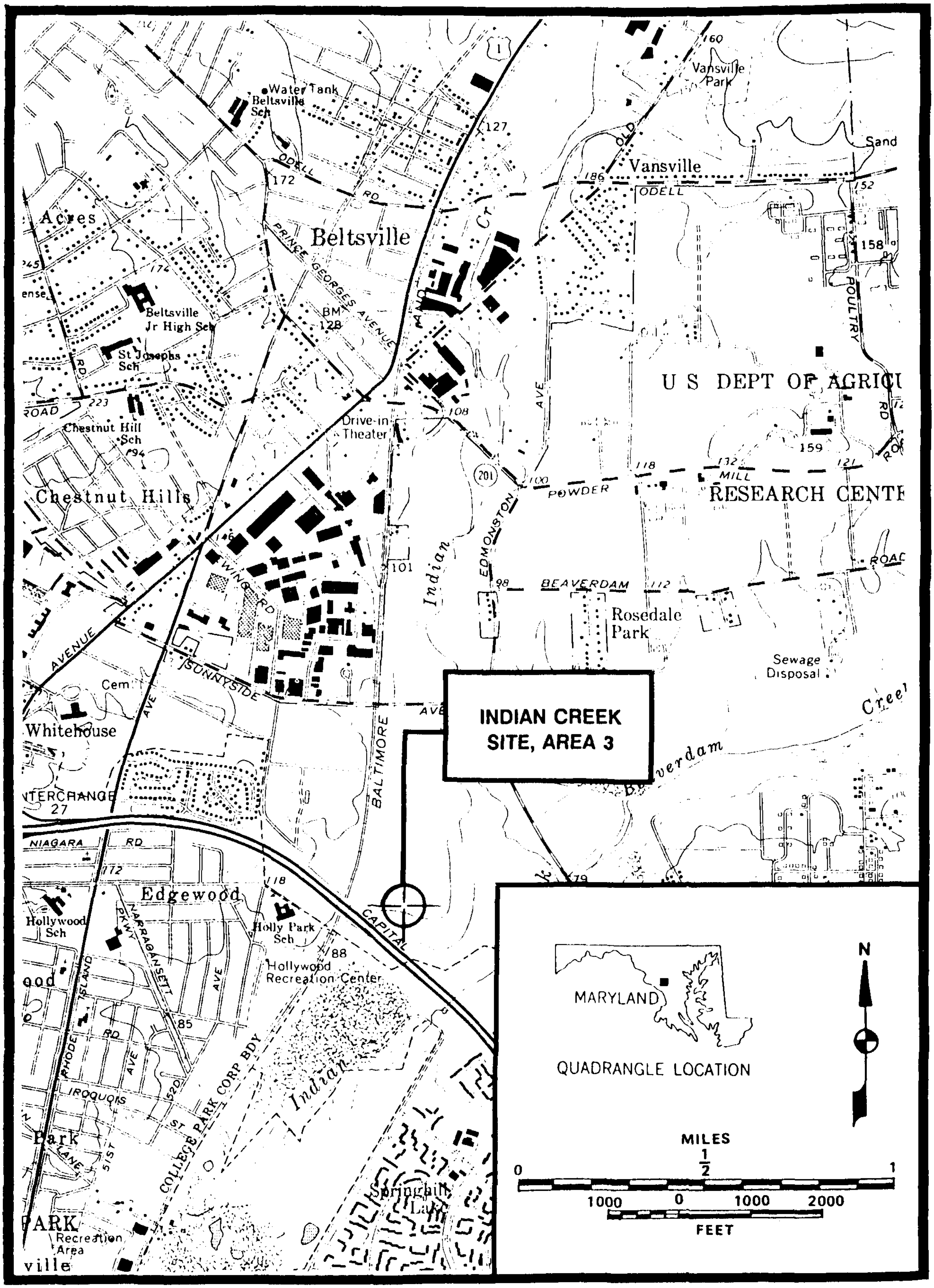


FIGURE 1: Vicinity Map SOURCE: USGS 7.5 Minute Series, Beltsville, Md. photorevised 1979

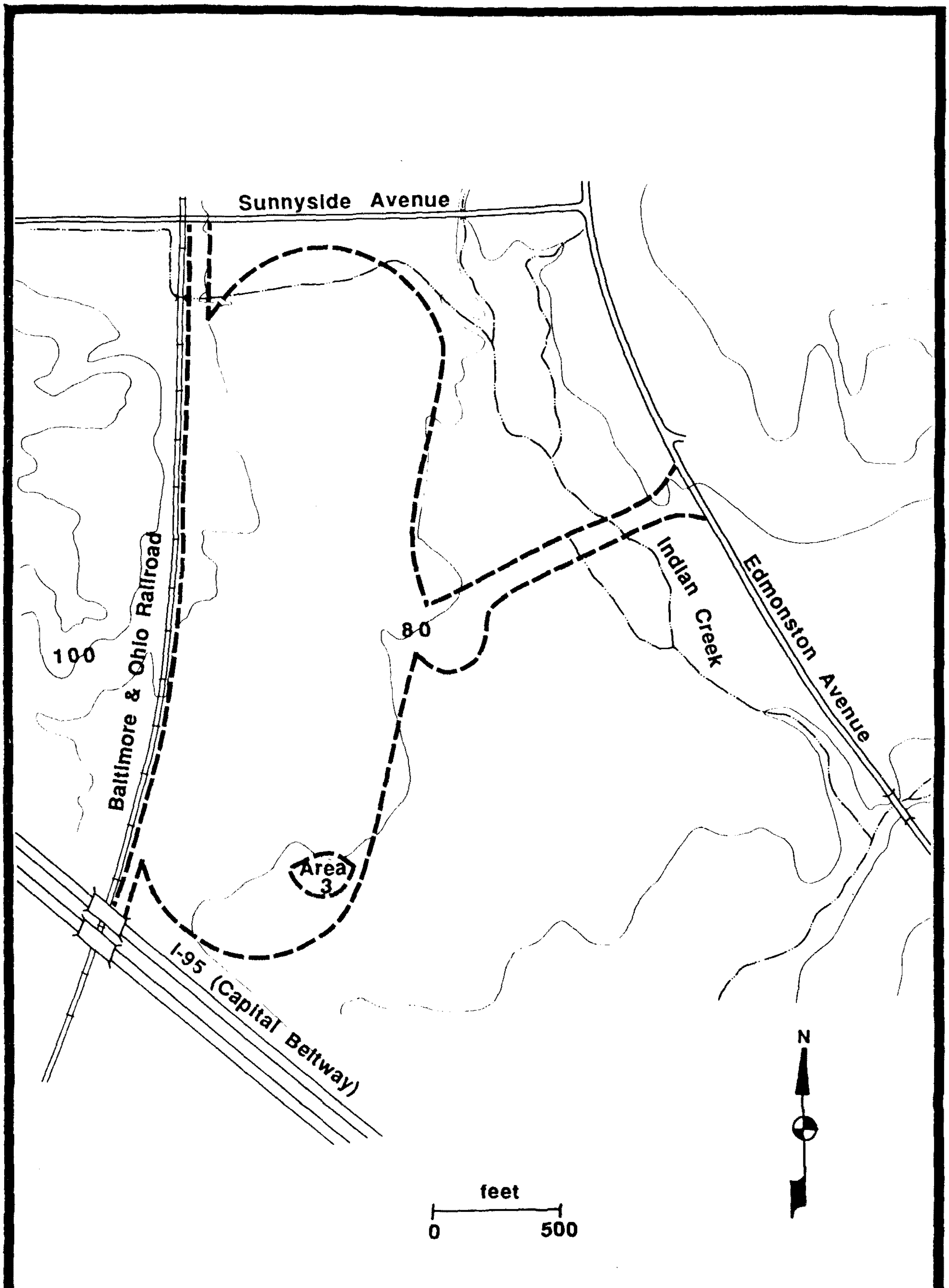


FIGURE 2: Project Area Map

Under the terms of this agreement, WMATA sponsored the present program of archaeological data recovery.

Fieldwork for the data recovery program was carried out over a 13-week period from January 9 to April 7, 1989. The excavations were completed by a field team that included, at times, as many as 14 persons. The excavation strategy focused on two objectives: (1) exploration of areas of the site that had not been tested thoroughly during the earlier testing program, and (2) exposure and recordation of activity areas around features. A total of 124 5x5-foot units were excavated during the data recovery program. Including the work carried out during the earlier survey and testing programs, approximately 3,600 square feet of Area 3 has been excavated.

The fieldwork was constrained to some degree by the necessity of working during the winter season. Heated shelters were constructed to alleviate the cold temperatures, so that only minor problems were encountered with frozen ground. A more significant challenge was posed by the seasonally high water table, a problem exacerbated by a high amount of rainfall during February, March, and early April. Midway through the fieldwork, the water table rose to less than two feet below the ground surface, thereby requiring the use of dewatering apparatus to complete the excavations.

The research findings from this study focus on issues of prehistoric chronology, subsistence, settlement patterns, environmental adaptation and technology. The site-specific chronology indicates two periods of intensive use, separated by an interval of abandonment or disuse. The two periods of occupation generally correspond to the Early Archaic and Late Archaic subperiods, with the interval of site abandonment occurring during the Middle Archaic. The Middle Archaic is poorly understood in the Middle Atlantic region, and it is not known whether or not abandonment of the Indian Creek Site corresponds to a general depopulation of the entire region.

The site occupies a low terrace of Indian Creek, adjacent to a gravel bar deposit, an extinct springhead, and an extensive wetland area. The site appears to have functioned as a seasonal gathering camp or procurement site. The gravel bar provided a local source of quartz and quartzite cobbles, while the wetland area would have provided numerous plant and animal resources. A limited variety of features were present within the site, including fire-cracked rock (FCR) concentrations, lithic workshop areas, and a charcoal concentration that may represent the remains of a steam pit. The FCR concentrations appear to be cooking areas, but it is not certain whether they were roasting hearths or rocks dumped after container boiling. The FCR concentrations are the most numerous features within the site, and they appear to have been the focus of various other activities carried out within the campsite's principal habitation area.

The site's lithic assemblage includes 60,000 tools and pieces of debitage, and is one of the largest excavated assemblages for this region. Lithic analysis focused primarily on issues of technology, function, style, and raw material selection and procurement. An extensive program of residue analysis was also undertaken.

One of the unique aspects of the Indian Creek Site is the association of a botanical assemblage consisting of 63 taxa that represent a variety of fruit, tubers, starchy seeds, nuts, shoots, and leaves. Nearly all of the analytically significant botanical specimens represent species of known ethnographic use, and comparison with off-site samples supports the argument that some of the on-site assemblage represents direct dietary or medicinal use of the various plant resources available in the adjacent wetland area. Another important result of this study was the discovery of a peat deposit in a nearby abandoned channel of Indian Creek. A pollen core extracted from the bog has provided a record of the local vegetation during the entire postglacial epoch. This has not only enabled a detailed examination of environmental adaptation at the Indian Creek Site, but it will provide an important frame of reference for other researchers in the Middle Atlantic region.

The body of this report is organized into ten chapters. The following chapter (Chapter II) presents a discussion of the background to this study, including an overview of the region's prehistory and a summary of prior work at the Indian Creek V Site. Chapter III includes a description of the site's environmental setting; it focuses primarily on a reconstruction of the conditions that would have been present during the prehistoric occupation of the site. The research design is described in Chapter IV, which inlcudes a discussion of the relevance of this study to the Maryland Historic Preservation Plan. Chapter V contains a discussion of the site's soils, stratigraphy, and the natural and cultural processes that influenced formation of the archaeological record. Chapter VI presents a discussion of the archaeological features, while Chapters VII and VIII contain the analyses of the lithic assemblage and the intrasite patterning of features and lithic material. Chapter IX reports the analysis of the site's floral and faunal assemblages. Chapter X provides a summary of the research findings as well as an evaluation of the research design and suggestions for future research.

This report is accompanied by a number of technical appendices that provide supporting documentation. These include detailed catalog listings and summaries of the archaeological collections and other information necessary to document Section 106 compliance.

The archaeological collections from the site have been prepared for permanent storage at the Maryland Historical Trust Office of Archeology, located in Annapolis. The field records and a complete set of artifact catalog listings have been prepared for storage with the collection.

II. BACKGROUND AND PREVIOUS RESEARCH

A. REGIONAL PREHISTORY

The prehistoric remains of the Potomac River Valley and the metropolitan Washington, D.C., area have attracted the attention of archaeologists and antiquarians since the late nineteenth century. The prehistoric cultural sequence for this area is fairly well documented, a result of the long-term interest of archaeologists. However, much of the basic information pertaining to the prehistoric cultural chronology has been derived from excavations at deeply stratified sites in the surrounding region (e.g., Broyles 1966, 1971; Chapman 1975; Coe 1964).

The major divisions of the prehistoric cultural sequence for the Middle Atlantic region, with their approximate beginning and ending dates, are as follows:

Cultural Period	Approximate Dates
Paleoindian	9500 - 8000 BC
Early Archaic	8,000 - 6,000 BC
Middle Archaic	6,000 - 4,000 BC
Late Archaic	4,000 - 1,000 BC
Early Woodland	1,000 - 500 BC
Middle Woodland	500 BC - A.D. 800
Late Woodland	AD 800 - 1600
Contact	AD 1600 - 1700

The Paleoindian period (circa 9500 BC to 8,000 BC) was characterized by a hunting and gathering subsistence pattern, followed by small, highly mobile nomadic bands. Large, fluted lanceolate projectile points, usually made of high quality cryptocrystalline lithic material, are the distinctive artifacts of this period, although the Paleoindian tool kit also includes scrapers, gravers, wedges, and bifacially flaked tools used for hacking, chopping, etc. Hunting of now-extinct megafauna was important in the Great Plains, but Middle Atlantic Paleoindian populations appear to have based their subsistence economy on the hunting of various game species, supplemented by fishing and foraging of vegetal foods available in the boreal forest environments that characterized this period (Custer 1990; Dent 1981; Gardner 1974, 1981, 1989; Kauffman and Dent 1982).

Based on extensive research in the Virginia Valley and Ridge province and neighboring areas, Gardner (1981, 1989) has suggested that the Paleoindian settlement pattern in the Middle Atlantic region was oriented primarily toward high-quality cryptocrystalline lithic source areas. There are no comparable lithic source areas in the Coastal Plain, and although scattered finds of fluted points have been reported, there has been insufficient research to define a distinctive Paleoindian settlement pattern for Maryland's Coastal Plain province. The little evidence that is available suggests an orientation toward riverine environments (Wesler et al. 1981). Research of this period is limited by the lack of deeply stratified or buried sites and by the fact that rising sea levels have submerged early Holocene riverine settings in the Coastal Plain.

Archaic period (circa 8000 BC to 1000 BC) lifeways were characterized by a hunting and gathering subsistence economy that included a variety of different food resources and a settlement pattern based on scheduled seasonal movements throughout various resource zones. Whereas Paleoindian lifeways were tightly focused on hunting and procurement of high-quality lithic material, Archaic lifeways were more diffuse, with a reliance on a broad array of resources (Cleland 1976). During the ensuing Woodland period, the Archaic hunting and gathering lifeways were eventually replaced by a more sedentary settlement pattern and a subsistence economy based on food production.

In the Middle Atlantic region, the Archaic period is poorly known, as most intensive site excavations have focused on the Paleoindian and Woodland periods. Hallmarks of the Archaic period include artifact assemblages that include tools for the processing of plant foods, a decreased emphasis on the use of high-quality cryptocrystalline lithic materials, and an increase in the importance of riverine and estuarine food resources. The Archaic period is typically divided into Early, Middle, and Late subperiods, although various terminal dates have been used for these subperiods by different investigators.

The Early Archaic period (circa 8000 BC to 6000 BC) showed a strong continuity with the preceding Paleoindian period. This continuity is evident in the settlement pattern and a preference for high quality cryptocrystalline lithic material (Gardner 1974, 1989). Gardner (1974) has argued that the Early Archaic economy had a primary emphasis on hunting, although other investigators (Dent 1981; Kauffman and Dent 1982; Wesler et al. 1981) argue that vegetal foods, particularly nuts and seeds, were also an important subsistence resource during this period. Paleoenvironmental studies indicate that the spruce-dominated boreal forest environments persisted into the Early Archaic, so that Paleoindian and Early Archaic populations lived in broadly similar environments (Custer 1990). Toward the end of the Early Archaic, the use of upland environmental settings became more important, suggesting that there was a broadening or diversification of the subsistence base, and there is also evidence that Early Archaic populations utilized a wider variety of lithic materials than the Paleoindian populations. A distinctive group of bifurcate-based projectile points was made during the latter portion of the Early Archaic (circa 7000 to 6000 BC), and these points typically exhibit greater use of local raw materials. Settlement pattern studies (Custer 1984, 1990; Gardner 1987; Steponaitis 1980; Stewart 1989a; Wanser 1982) in the Middle Atlantic clearly show a strong association of bifurcate points with wetland habitats, variously described as interior swamps, freshwater marshes, ponds, bay/basin features, or springheads. Some of the major settlement foci associated with the Bifurcate tradition in this region include Dismal Swamp, Zekiah Swamp, Mattawoman Swamp, Churchman's Marsh, and other smaller wetland areas.

The Middle Archaic period (circa 6000 BC to 4000 BC) was marked by the use of distinctive projectile points and by the appearance of groundstone tools and a wider variety of lithic materials. The types of groundstone tools found in Middle Archaic assemblages (axes, nuttingstones, mortars, etc.) suggest an increasing adaptation to the hardwood forest biome that characterized this period. The Middle Archaic is perhaps the least well known of the Archaic subperiods for the Middle Atlantic region, but a generalized hunting and gathering economy is postulated for the Coastal Plain.

The Late Archaic (circa 4000 BC to 1000 BC) is marked by the appearance of more diverse artifact forms and sites in an increased variety of environmental settings. A generalized hunting and gathering subsistence strategy was followed during this period; exploitation of riverine and estuarine resources became more important at the end of the Late Archaic, judging from the presence of fishing implements in the artifact assemblages and the abundance of sites in estuarine and riverine environments. Intensive shellfish gathering appears to have become important during the Late Archaic, not only in the Coastal Plain but other interior riverine zones as well. In the metropolitan District of Columbia area, there are numerous Late Archaic sites in riverine settings (Humphrey and Chambers 1977); however, excavations at the Bazuin Site, located along the Potomac River in Loudoun County, Virginia, failed to produce substantial evidence that fishing was an important activity during the Late Archaic occupations (Larsen et al. 1980). The principal diagnostic artifacts associated with the Late Archaic are a variety of stemmed points; other items in the Late Archaic tool kit include axes, choppers, mortars, pestles and other implements that appear to have been used for processing of plant foods (Mouer et al. 1981). Carved steatite vessels were also first manufactured during the Late Archaic.

The Woodland period (circa 1000 BC to European contact, circa AD 1600) is better known in the Middle Atlantic region than the preceding Paleoindian and Archaic periods. The Woodland period is typically subdivided into Early (circa 1000 BC to 500 BC), Middle (circa 500 BC to AD 800) and Late (circa AD 800 to 1600) subperiods, but Custer (1984) has suggested a revision of the traditional chronology, substituting the terms Woodland I and Woodland II. According to Custer's revised chronology, the Woodland I period includes the traditional Late Archaic, Early Woodland, and Middle Woodland subperiods, while his Woodland II unit is comparable to the traditional Late Woodland subperiod. Because the principal cultural manifestations (i.e., Adena and Hopewell) that distinguish the Early, Middle, and Late Woodland subperiods were infrequently seen in the Middle Atlantic region, Custer's terminology has merit. For Fairfax County, Virginia, Johnson (1986) has proposed a similar chronological unit that combines the traditional Late Archaic, Early Woodland, and Middle Woodland subperiods into a period termed Hunter-Gatherer IV.

The major diagnostic traits of the Woodland period include larger populations, increased complexity of social organization, the introduction of ceramics, a settlement pattern characterized by increased sedentism, and a subsistence pattern that includes horticulture. A generalized pattern of seasonal hunting and gathering persisted from the Late Archaic into the Early and Middle Woodland subperiods; however, during the Late Woodland, when horticulture assumed greater importance, seasonal population movements gave way to more sedentary village life. Woodland occupations are most readily recognized by the presence of ceramics, and in the District of Columbia metropolitan area the local sequence includes Marcey Creek (steatite-tempered), Selden Island (steatite-tempered), Accokeek Creek (sand/grit-tempered), Popes Creek (sand/grit-tempered) and Mockley (shell-tempered) and Potomac Creek (sand-tempered) wares (Johnson 1986).

During the Early and Middle Woodland, a pattern of seasonal hunting and gathering continued, with emphasis on the exploitation of aquatic resources. Early Woodland manifestations are not well known in the Maryland Coastal Plain, and there are almost no excavation data pertaining to Middle Woodland. An Early Woodland component was excavated at the Monocacy Site. Seasonally abundant anadromous fish were exploited below the Fall Line in the District of Columbia area, and there are a number of riverine-oriented sites occupied from the Late Archaic through the Middle Woodland subperiods. At the regional scale, Gardner (1982) has observed that the Late Archaic and Early/Middle Woodland settlement patterns in the Outer Coastal Plain may be distinguished by a shift in the location of principal settlements (i.e., macro-social unit base camps) away from interior swamps to estuarine loci where shellfish collecting was a primary focus of the subsistence pattern. The pattern is less clear in the Inner Coastal Plain, but the evidence suggests that the Early Woodland settlement pattern was characterized by seasonal interzonal movements between the freshwater and saltwater zones. In this dual focus model, macro-social unit base camps were alternately occupied in the freshwater and saltwater zones; because both zones were highly productive, there was less need for fission of the social units during the seasonal settlement shifts (Gardner 1982).

Incipient agriculture may have been practiced during the Early Woodland, but it is not until the Late Woodland that a significant settlement pattern shift is visible that is suggestive of a shift to subsistence agriculture. During the Late Woodland, villages became larger and more permanent, and tended to be located adjacent to areas with easily worked floodplain soils. In addition to major village sites, the Late Woodland settlement system included smaller outlying hamlets and special-use sites such as hunting camps and fishing and shellfish-gathering stations, although the importance of these secondary sites may have diminished as agricultural technology developed (Gardner 1982; Potter 1982; Waselkov 1982).

Regular contact between European and Native American groups along the Eastern Seaboard began early in the sixteenth century. However, it was not until the early seventeenth century that the Late Woodland groups of the Chesapeake area were brought into a direct relationship with Euro-American groups. Shortly after the Jamestown Colony was founded in 1608, explorers and traders established regular contacts with the aboriginal inhabitants of the Tidewater Potomac area, and a major trading site was established at Nacotchtank village on the lower Anacostia River. European traders apparently did not venture above the Fall Line during the early seventeenth century.

B. PREVIOUS ARCHAEOLOGICAL STUDIES

Archaeological studies have been conducted in the District of Columbia vicinity for more than a century, and the Anacostia River Valley has long been recognized as an important focus of aboriginal activity. The first comprehensive synthesis of the prehistory of the District of Columbia resulted from an 1889 symposium sponsored by the Anthropological Society of Washington. S.V. Proudfit presented a paper entitled "Ancient Village Sites and Aboriginal Workshops in the District of Columbia" (Proudfit 1889). The paper included a map which purportedly indicated the location of all known archaeological sites within the District of Columbia borders. Approximately 45 sites were mapped, primarily along the Potomac and Anacostia rivers. Because Proudfit's study was limited to the District of Columbia, it is not known whether the Indian Creek area in Prince Georges County had yet been discovered by the late-nineteenth-century anthropologists. However, it is clear that by then the aboriginal occupation of the Lower Anacostia River was well known.

William H. Holmes of the United States National Museum, Bureau of Ethnology, provided the first synthetic studies of the Chesapeake-Potomac region. Holmes made extensive studies of the region's aboriginal pottery and stone tool industries, and conducted some of the first scientific archaeological work in the District of Columbia. Straddling the interface between the Piedmont and Coastal Plain, the District of Columbia afforded the region's aboriginal populations a wide range of lithic resources. To Holmes, the District of Columbia was of major archaeological importance, as the area contained the largest known "bowlder" quarry (near 14th Street), important steatite (soapstone) quarries, the most important aboriginal village site in the entire Tidewater Province (the site of Nacotchtank on the Lower Anacostia River), and an extensive fishing ground along the banks of the Potomac up to Little Falls. Holmes noted that evidence of aboriginal quarrying could be observed throughout the city wherever suitable outcrops of lithic material were located. These sources included the steatite quarries centered on Rock Creek and its tributaries and secondary cobble deposits exposed along the Lower Anacostia (Holmes 1897; 1919).

Holmes, a geologist by training, conducted some of the earliest studies of aboriginal tool manufacturing technology. Based on excavations at the Piney Branch quarries, he identified three distinct types of activity areas associated with the quarry site: (1) the *quarry pit* where the lithic raw material (quartz and quartzite cobbles) was removed from the hillside, (2) the *quarry shop*, a working area near the quarry pits where the first stage of the shaping process was performed, and (3) the *trimming shop* , a nearby location where secondary trimming of the lithic implements was completed. Based on analysis of the refuse material left at the quarry sites, Holmes described the lithic tool reduction sequence that was utilized at the Piney Branch quarry sites. At the quarry sites, the final product was a form termed the leaf-blade or leaf-shaped blade; this was a bifacially flaked implement, symmetrically oval or lanceolate in outline, and it was reduced further to a finished tool at another location. Three intermediate stages in the production of the leaf-blade were identified at the quarry sites: the turtleback (a cobble with flakes removed from one side), the double turtleback or incipient blade (a cobble with flakes removed from both sides), and the well-advanced blade (Holmes 1897, 1919).

Holmes studies endured for decades as the most comprehensive treatment of Potomac Valley archaeology, although collectors remained active through the early twentieth century. After more than 50 years of local activity, Titus Ulke (1935) prepared a brief summary that included a map of all then-known quarry and village sites in the District of Columbia vicinity. Ulke's study encompassed the adjacent areas of Maryland and Virginia and he noted the presence of aboriginal quarries and villages at Paint Branch, which is nearly as far upstream within the Anacostia River Valley as Indian Creek. No sites along Indian Creek were indicated on Ulke's map.

In the late 1950s, Howard A. MacCord provided a summary of prior archaeological work in the Anacostia River Valley and briefly reported the excavation of a site near Kenilworth, Maryland. Drawing on earlier reports and unpublished sources, he observed that aboriginal sites had been identified throughout the Anacostia Valley, but that they had been virtually destroyed by modern urban development such as the Anacostia Park and Highway System, the Naval Air Station and Bolling Air Force Base. MacCord noted that the major pottery-producing sites were located along the eastern or left bank of the river and that the sites located along the tributary streams usually lacked pottery but did contain stone tools typical of the Archaic period. It is not known whether MacCord visited the Indian Creek area (MacCord 1957).

The Indian Creek area has been known to collectors for at least the past 15 years, and a number of prehistoric sites have been reported along its terraces and floodplain. Five prehistoric sites along Indian Creek were reported to the State Archeologist, Maryland Geological Survey, by Dennis Webb, a local collector. One of the sites reported by Webb is the Indian Creek V Site (18PR94) which is the subject of the present study. Webb's collection from 18PR94 included a bannerstone fragment, a bifurcate-based point, and various Archaic points made of quartz and rhyolite.

Federal cultural resource management regulations have not only provided the impetus for the present study, but they have also led to a rapid increase in the amount of archaeological information that is available for the Indian Creek vicinity and surrounding region. A few cultural resource management projects have included portions of the Beltsville Agricultural Research Center and nearby areas.

The Indian Creek V Site (18PR94) was visited briefly during a survey of a proposed water main alignment along the outer perimeter of I-495 (Gardner and Stewart 1978). While the site was determined to be well outside the project impact area, the investigators did observe a soapstone fragment and various quartzite, quartz, and rhyolite flakes on the surface of Site 18PR94. Using predictive models developed by Gardner (1978), the investigators suggested that the primary environmental features that would have attracted prehistoric settlement in their study area were the presence of secondary cobble and gravel deposits and broad floodplain and marsh habitats.

Two undeveloped parcels within the Beltsville Agricultural Research Center were surveyed by Mid-Atlantic Archaeological Research, Inc. (Schiek 1984), resulting in the identification of three prehistoric sites and an isolated find spot (18PRX25). Site 18PR206, described as a transient upland activity area, had been previously identified. The other sites, 18PR208 and 18PR209, were described as small Archaic camp sites (Schiek 1984).

The planned extension of the Washington Metropolitan Area Transit Authority's (WMATA) METRO Rail service to northern Prince Georges County has led directly to the present data recovery program at the Indian Creek V Site. The present study represents the third phase of archaeological work carried out at the WMATA Greenbelt Yard facility.

The initial archaeological survey of the Greenbelt Yard facility was begun in November 1986. Two prehistoric sites (18PR93 and 18PR94) had previously been reported by Dennis Webb within the 70-acre study area. Documentary research demonstrated that the area had not been occupied during the historic period, but there was cartographic evidence of a late-nineteenth-century limekiln at the northwest boundary of the survey area, at the intersection of Sunnyside Avenue and the B&O Railroad. The field survey began with a controlled surface collection of all visible prehistoric material, which demonstrated a low density of surface material across the cultivated area rather than two distinct site areas as reported by Webb. The surface collection was followed by systematic shovel testing, with tests placed at the grid intersection points used for the surface collection. The shovel tests indicated that most of the 70-acre facility contained a low-density lithic scatter, including the forested areas along the margins of the project area. A series of backhoe trenches was also excavated to determine whether buried surfaces were present and to examine the supposed location of the limekiln. Based on the results of the surface collection and shovel testing, four areas of somewhat concentrated prehistoric material were identified. These areas were subjected to more intensive shovel testing and the excavation test units, primarily 3x3-foot squares. The test units demonstrated that most of the prehistoric deposits were confined to eroded, plowzone contexts. However, Area 3, located in a reforested section in the southeast portion of the survey area, was determined to have undisturbed prehistoric deposits that extended to a depth of approximately 2.0 feet below ground surface.

The survey collections included various projectile points, scrapers, utilized flakes, cores, bifaces at various stages of reduction, and fire-cracked rock. A variety of projectile points were recovered from the survey area, including bifurcate-based, corner-notched, side-notched, and triangular forms, and the projectile point styles indicated that the survey area had been utilized throughout the Archaic period, with some Woodland period activity as well. The survey area appeared to have been used primarily for hunting and lithic procurement and reduction activities (LeeDecker et al. 1988).

Because Area 3 contained apparently well-preserved prehistoric deposits, a program of site testing and evaluation was authorized by WMATA in September 1987. The overall testing strategy for the Phase 2 program was guided by several objectives: (1) obtain a larger sample of the prehistoric deposits, to permit identification of the site's function and period of occupation, (2) establish better definition of the site's vertical and horizontal extent, (3) determine the extent to which post-depositional mixing or disturbance had occurred, and (4) determine whether intact subsurface features or activity areas were present.

The Phase 2 program for Area 3 involved excavation of 20 5x5-foot units. The shovel testing undertaken during the survey of Area 3 had delineated an area measuring roughly 130x200 feet that contained a relatively high concentration of lithic material, and the majority of the Phase 2 units were also placed within this area. A few of the Phase 2 units were placed in areas where the shovel testing had suggested secondary concentrations of material, or in areas that did not appear to have been sampled adequately by the shovel tests.

The Phase 2 program provided a detailed assessment of the natural stratigraphy within Area 3. First, a clearly defined plowzone was recognized by the presence of plowscars that were consistently oriented in a northwest-southeast direction. The subsoils were typically of a fine sandy texture, becoming paler with depth. Marbled argillic horizons were typically found at depths more than two feet below the surface. Gravel and cobble inclusions were noted within the north-central section of Area 3, indicating the presence of a relic gravel bar.

Analyses directed at assessment of the site's vertical stratigraphy produced mixed results. While there was no evidence that the local soils had been redeposited or reworked by alluvial processes, it was apparent that some mixing of the prehistoric deposits had occurred. The observed vertical mixing appeared to have been a result of various bioturbation processes and frost-heave.

Diagnostic projectile points indicated that Area 3 was utilized throughout the Archaic period (circa 8000 to 1000 BC). The most intensive use of the area probably occurred during the Late Archaic period, judging from the frequency of projectile points attributable to this period. A number of the diagnostic projectile points have temporal ranges that extend into the Woodland period, but the complete lack of prehistoric pottery suggested that Area 3 was used or occupied only on an infrequent basis after the Archaic period.

Prehistoric materials were found as deep as 1.6 feet below the base of the plowzone, and approximately 70 percent of the material was from undisturbed subsoil contexts. However, the presence of well-preserved prehistoric features was of greater significance. These included two concentrations of fire-cracked rock, Features 2 and 3; and two concentrations of fire-cracked rock and lithic reduction debris, Features 4 and 5. Features 2 and 3 were interpreted as possible cooking areas or dumps resulting from the discard of heated stones that had been used in plant food processing. Features 4 and 5, located in proximity to the gravel bar, were interpreted as lithic workshop areas. Intrasite pattern analysis focused on the gross horizontal distribution of artifacts and raw materials within Area 3 suggested that a number of discrete lithic workshop areas were present, representing specific stages in the lithic reduction sequence or the treatment of specific raw materials. The analysis suggested that a staggered, sequential lithic production system was represented at the site, that is, one in which different stages of the tool manufacturing process were spatially segregated. Primary reduction of bifacial implements appeared to have been a major activity, but there were also a number of activity areas related to tool rejuvenation or the final shaping of finished implements.

Specialized analysis demonstrated the preservation of blood residues on approximately one-quarter of the lithic implements submitted for testing. The test results indicated only the presence or absence of blood residues, as no reliable technique for species identification was available. Flotation analysis demonstrated that Area 3 contained well-preserved floral remains. Seeds and macrospores extracted from the flotation samples included a high percentage of charred, edible, and native species, indicating their probable use during the site's prehistoric occupation.

Certain tubers identified within the prehistoric assemblage would have been available on a year-round basis. The greatest diversity of edible flora would have been available from March through November, so that the winter months would have been characterized by a relative scarcity of edible herbs, seeds, tubers, and greens. The large number of projectile points in the assemblage indicated that faunal species also played an important role in the overall subsistence pattern. The aboriginal occupants of Area 3 probably would have responded to seasonal game movements as well as the availability of flora, but the presence of a well-preserved floral assemblage indicated that the site was probably used most intensively during the spring and summer months.

Area 3 also contained a historic dump, more precisely a number of small, localized trash deposits. Historical research indicated that the area was never occupied, and the recovered assemblage was not indicative of a residential use. The dominance of faunal refuse (bone and shell) and the lack of architectural items in the historic assemblage clearly indicated that the deposits were not attributable to an on-site residential occupation. Instead, the assemblage gave the impression of having originated in a restaurant or hotel, and the datable artifacts indicated a twentieth-century deposition. The historic ceramic assemblage was dominated by hotelware but also included whiteware, ironstone, stoneware, yellowware, and a single sherd of coarse red earthenware. The glass assemblage included liquor and condiment bottles, generalized bottle forms of undetermined function, and a few tumbler fragments. The bone assemblage included mammal, fish, and bird species but exhibited relatively little variety. Chicken, cow, pig, sheep, oyster, and clam were the most frequently identified species (LeeDecker et al. 1988).

III. ENVIRONMENTAL SETTING

A. PHYSIOGRAPHY AND GEOLOGY

The Indian Creek V Site is within the Atlantic Coastal Plain physiographic province near the boundary of the Piedmont physiographic province (Figure 3). Area 3 occupies a low terrace adjacent to a broad, marshy floodplain of Indian Creek. Within Area 3, surface elevations range between 81 and 83 feet above mean sea level, with a slope of less than 2 percent within the two-acre site.

The Coastal Plain physiographic province is generally characterized by low-lying topography and gradual changes in elevation. Whereas Maryland's Eastern Shore subdivision of the Coastal Plain is virtually a flat, featureless plain, the Western Shore subdivision, which encompasses the Indian Creek Site, exhibits a more rolling, dissected topography similar to that of the Piedmont. The Piedmont physiographic province, which lies roughly along the border of Prince Georges and Montgomery counties, is approximately three miles west of the site. Locally, the boundary between the Coastal Plain and the Piedmont is not well defined, as it is characterized by the feathering out of the Coastal Plain sediments onto the crystalline rock formations of the Piedmont. Along major watercourses, the Piedmont-Coastal Plain boundary is marked by the Fall Line, a rapid drop in stream gradient such as occurs on the Potomac River just above Georgetown (Vokes and Edwards 1974).

The Coastal Plain was formed by the deposition of material transported from beyond the Fall Line, and it is characterized by masses of unconsolidated sediments comprised of sands, gravels, and clays of marine or fluvial origin. The upland surface in the Indian Creek Site vicinity is formed by the Wicomico terrace, a Pleistocene formation found between 45 and 90 feet above sea level. The Wicomico terrace and gravels occupy extensive areas of the Eastern Shore, but only small, scattered areas on the Western Shore, primarily along the Potomac and Patuxent rivers (Matthews 1933; Vokes and Edwards 1974).

The broad valley bottom centered on Indian Creek exhibits numerous gravel exposures, and these appear to represent relic gravel bars left by the shifting course of the ancestral Indian Creek. Area 3 partially overlaps one of these relic gravel bars, and the availability of secondary cobble and gravel deposits appears to have been a key factor in attracting aboriginal use of the site. Quartz, quartzite, and sandstone cobbles, available from the numerous gravel bars in the Indian Creek bottomlands, were extensively used during the prehistoric occupation of the site.

Limonite (ironstone) was an important material in the prehistoric technology, as it is the dominant material used in the numerous fire-cracked rock features identified at Area 3. Small limonite nodules may be observed in a light scatter across the Indian Creek bottomlands, but it appears that the principal source area for this material is the Arundel formation, which occupies scattered upland areas adjacent to the juncture of Indian Creek and Beaver Creek. The Arundel formation is of Cretaceous origin and is composed primarily of red and brown clays, but it also includes concretions of sandstone cemented with iron oxide/carbonate and nodules of iron carbonate and limonite. Historically, the iron carbonate and limonite were extracted as a source of iron ore, and the Arundel clays were an important source of raw material for brick, terra cotta, and pottery (Matthews 1933; Vokes and Edwards 1974:47-48).

The nearby Piedmont area, characterized by a zone of metamorphic bedrock, would have provided a wider range of lithic raw materials for the aboriginal site inhabitants. Rock types available in the Eastern Division of the Piedmont include gneiss, slate, phyllite, schist, marble, serpentine, granite, and gabbro. The eastern portion of Montgomery County is occupied by the Wissahickon

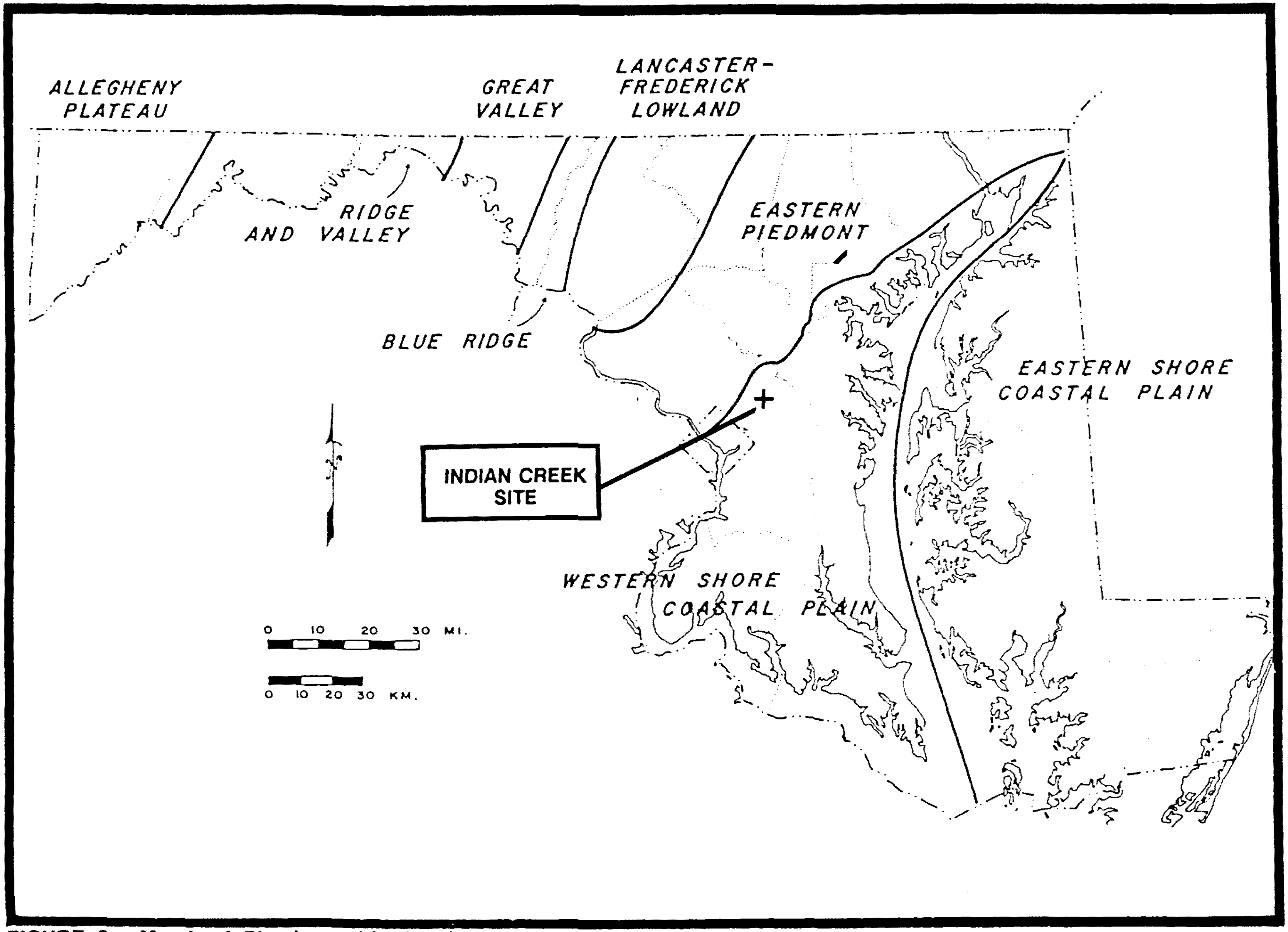


FIGURE 3: Maryland Physiographic Provinces

formation. In the exposure along the Montgomery/Prince Georges County line, this formation is represented by oligoclase-mica schist that includes thin bands of quartzite. Steatite (soapstone) deposits occur within the Wissahickon formation at the Piedmont/Coastal Plain interface, especially in ravines and on cliffs and hilltops. There are several major steatite outcrops in the District of Columbia, the most prominent being in the Rock Creek vicinity. Aboriginal use of these steatite quarries has been studied since the late nineteenth century (Holmes 1897; Humphrey and Chambers 1977). Exposures of greenstone and serpentine occur further west in the Piedmont, between Rockville and Great Falls (Matthews 1933; Vokes and Edwards 1933:47-48).

Rhyolite and various cryptocrystalline rocks (chert and jasper) were also important in the aboriginal technology. These materials may have been available in secondary form as scattered cobbles, but it is more likely that they were obtained at a primary source. Outcrops of rhyolite occur primarily within a relatively restricted area in the Blue Ridge Province, approximately 55-60 miles from the Indian Creek Site (Stewart 1984). Cherts suitable for aboriginal tool manufacture are widely distributed throughout the Appalachian Highlands.

Area 3 occupies a terrace of Indian Creek that appears to have been more or less stable since the late Pleistocene. The age of the terrace is demonstrated by the degree of subsoil development, and absence of appreciable flooding on the terrace surface, and the early Holocene radiocarbon dates (10,800 $\pm$ 200 years BP [Before the Present] [Beta 42668] and 10,660 $\pm$ 90 years BP [Beta 37871]) obtained at the base of a nearby peat deposit in an abandoned creek channel.

Area 3 is now located more than 1,500 feet from the present Indian Creek channel, and for most of the Holocene the site was seldom if ever in much closer proximity to the creek. Although early in the Holocene the creek was apparently laterally cutting the edge of the terrace landscape just northeast of the site, after about 11,000 years BP, the creek underwent a major eastward shift and has remained largely removed from the site area ever since.

B. HYDROLOGY

The site occupies a low terrace of Indian Creek, a tributary of the Northeast Branch, which in turn empties into the Anacostia River. Indian Creek is a freshwater stream with its headwaters located approximately six miles upstream of the site. In the immediate site vicinity, the creek is characterized by a braided channel morphology, and the streambed drops approximately four to five feet per thousand feet in longitudinal profile. Extensive freshwater wetland areas flank Indian Creek in the site vicinity, and tidal marsh areas are located along the lower Anacostia River, approximately six miles downstream from the site.

The present channel of Indian Creek lies roughly 1500 feet to the southeast of Area 3, although the floodplain is marked by a number of abandoned channels, and it is apparent that the creek's hydrological history has involved frequent shifting of the channel course. An abandoned channel of Indian Creek is located approximately 400 feet to the northeast of Area 3. This abandoned channel was filled with a highly organic peat deposit that yielded basal radiocarbon dates which indicate that the channel was abandoned prior to the aboriginal occupation of Area 3.

A geomorphological survey of the site vicinity located two possible drainages that may have provided an immediate water source during the site's prehistoric occupation. A small drainage ditch located to the south of the site possibly represents a former intermittent drainage, but no apparent former channels were observed in the immediate vicinity; therefore it is uncertain whether the present ditch location represents anything but a shallow swale with little or no surface flow.

The geomorphological survey did locate evidence of a spring at the northeast periphery of Area 3. The spring location was identified by the presence of standing water during the wet season (winter), but there was no visible evidence of a channel. The soil profile revealed by augering indicated the presence of stratified sands with no subsoil development, which distinguished this setting from the surrounding well-developed terrace soils that characterized Area 3. The stratified sands appear to represent recent alluvium that filled a small stream channel fed from the terrace. During the prehistoric occupation of Area 3, a spring feeding this small stream channel may have provided the only water source in the immediate site area.

C. SOILS

The Indian Creek Site is within the Bibb-Tidal Marsh soil association, which is generally characterized by poorly drained floodplain soils and marshes that are subject to frequent flooding. This association is found along the larger streams of the vicinity that flow into the Patuxent and Potomac rivers. Area 3 lies within an area mapped as Keyport fine sandy loam, a soil that is moderately well drained but which has a tendency to excessive wetness in the spring.

The principal soils that have been mapped within the site vicinity are described in Table 1, together with a brief description of their major characteristics. Figure 4 indicates the distribution of these soils, as derived from the USDA mapping (USDA 1967). Two soils in the immediate site area are classified as hydric--Johnston silt loam and Bibb silt loam. Soils exhibiting hydric characteristics are those with poorly oxidized subsoil, which is indicative of frequent flooding or saturation for long periods. The hydric soils correspond to the broad wetland area which is roughly coterminous with the Indian Creek floodplain (WMATA 1978).

A pedological and geomorphological study of the Area 3 site and surrounding Indian Creek floodplain was undertaken in conjunction with the archaeological excavations. The results of that study (Wagner 1990) are summarized below and are included in full in Appendix P.

The Area 3 site is occupied by very sandy, moderately well-drained terrace soils containing marbled argillic subsoil horizons. Subsoil development is weak, and even the clay-enriched argillic horizon textures are rarely finer than loamy sand. The upper soil horizons are also loamy sand, and the texture of the parent material (C horizons) beneath the soil is also sand (Wagner 1990).

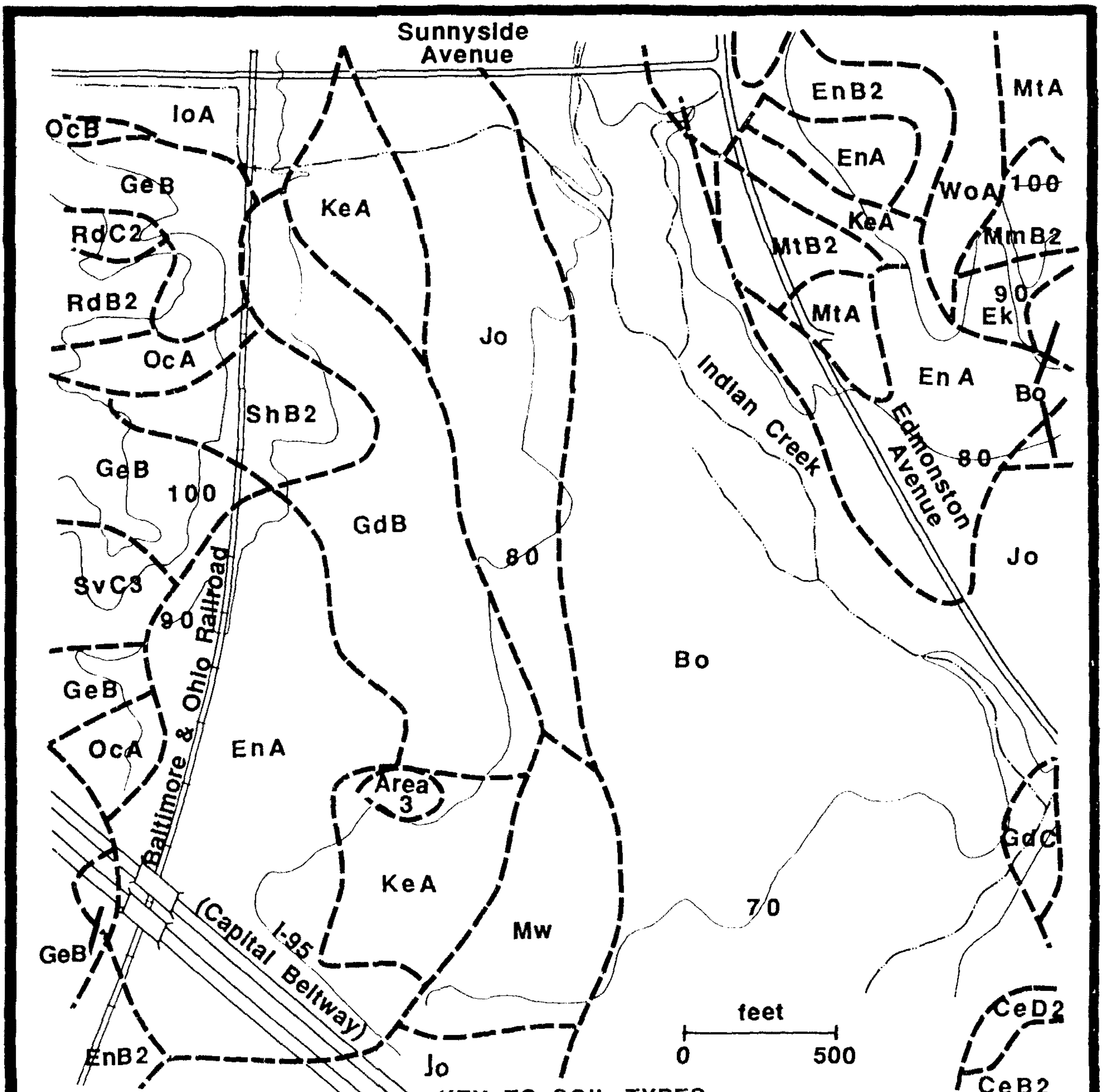
Figures 5 and 6 portray the distribution of soil particle size fractions in soil profiles exposed in two excavation units. The very sandy nature of the soils is apparent, but increasing clay contents with depth clearly demonstrate the presence of argillic horizons. Demonstrating some variability in the site soils, argillic horizon clay contents are nearly twice as great in the profile of Unit 40 as in that of Unit 49. Increases in subsoil clay contents are relatively slight in both profiles, suggesting both weakly developed and hence relatively young argillic horizons. However, argillic horizon expression, although heavily age dependent, may be weak even in very old sandy soils (Wagner 1990).

The broken, marbled nature of the argillic horizons is significant in assessing the potential age of the site soils and landscape. The argillic horizons do not occur as homogeneous layers, but rather as disrupted bodies mixed with bodies having few or no characteristics normally associated with argillic horizons. These contrasting materials were considered to have properties more closely related to either a transitional type of subsoil horizon when near the top of an argillic horizon, or to essentially unweathered parent material in the lower portion of an argillic horizon. When sampling these mixed horizons as a layer, particle size analyses would reflect clay contents averaged between the two materials. These averaged values would be indicative of weakly developed argillic horizons; however, when the contrasting materials were sampled separately, much more pronounced differences in clay contents demonstrated more advanced argillic horizon development. Separately sampled argillic bodies contained six to nine times more clay than the parent materials in which they are formed (Wagner 1990).

TABLE 1. CHARACTERISTICS OF PRINCIPAL SOILS IN SITE VICINITY.

SOIL TYPE	CHARACTERISTICS
Bibb silt loam	Deep, level or nearly level poorly drained soils located along floodplains; derived from recently deposited material from sandy and silty uplands; wet for long periods.
Elsinboro sandy loam	Deep, well drained alluvial soils located on old terraces or benches above the present floodplain; allluvium was derived from Piedmont soils that contained large amounts of mica; contains scattered gravelly patches in the surface layer.
Galestown loamy sand	Deep , excessively drained sandy soils typically found near but elevated above drainageways; gravels comprise15 to 20% of the mass and form the substratum (C-horizon); the soil is very easily eroded and often reworked by wind and water.
Iuka silt loam	Nearly level to moderately sloping, moderately well drained soils located on floodplains, depressions and footslopes; derived from recently deposited material from sandy and silty uplands.
Johnston silt loam	Poorly drained, excessively wet soils with a thick, dark organic surface layer; found on floodplains; formed in recently deposited silts that have been washed from nearby uplands.
Keyport fine sandy loam	Deep, moderately well drained, nearly level soils with a mottled, fine-textured subsoil; tend to be wet in spring; slow permeability.
Mattapex fine sandy loam	Deep, moderately well drained soils on nearly level to moderately sloping uplands.
Mixed alluvial land	Deposits on floodplains that range from sand to clay; formed in material washed from various upland soils.
Sassafras sandy loam	Deep, well drained soils located on uplands; includes some spots with gravel in the surface layer.

Source: USDA (1967).



KEY TO SOIL TYPES

Bo	Bibb silt loam
CeB2	Christiana silt loam (2-5% slopes)
CeD2	Christiana silt loam (10-25% slopes)
Ek	Elkton silt loam
EnA	Elsinboro sandy loam
EnB2	Elsinboro sandy loam, (2-5% slopes)
GdB	Galestown loamy sand, (0-8% slopes)
GdC	Galestown loamy sand, (8-15% slopes)
GeB	Galestown-Evesboro loamy sands (0-8% slopes)
In	Iuka silt loam
IoA	Iuka silt loam, (0-2% slopes)
Jo	Johnston silt loam
KeA	Keyport fine sandy loam (0-2% slopes)
MmB2	Matapeake fine sandy loam (2-5% slopes)
MtA	Mattapex fine sandy loam (0-2% slopes)
MtB2	Mattapex fine sandy loam (2-5% slopes)
Mw	Mixed alluvial land
MzB2	Muirkirk loamy sand (0-5% slopes)
OcA	Ochlockonee sandy loam (0-2% slopes)
OcB	Ochlockonee sandy loam (2-5% slopes)
RdB2	Rumford loamy sand (2-5% slopes)
RdC2	Rumford loamy sand (2-5% slopes)
ShB2	Sassafras sandy loam (5-10% slopes)
SvC3	Sunnyside sandy clay loam (5- 10% slopes)
WoA	Woodstown sandy loam (0-2% slopes)

FIGURE 4: Distribution of Soil Types in Area 3 Vicinity

SOURCE: USDA (1967)

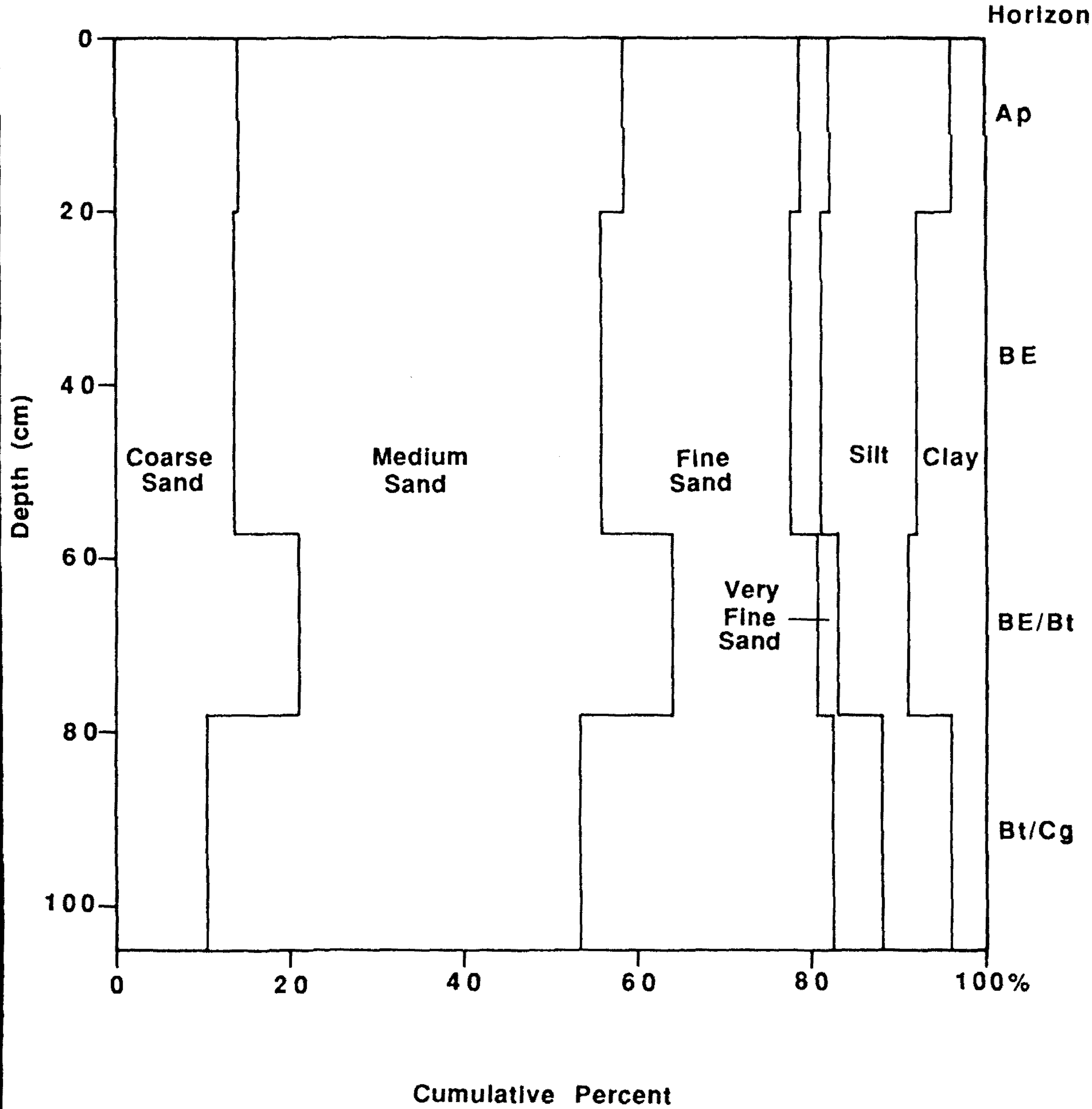


FIGURE 5: Distribution of Soil Particle Size With Depth, Excavation Unit 40

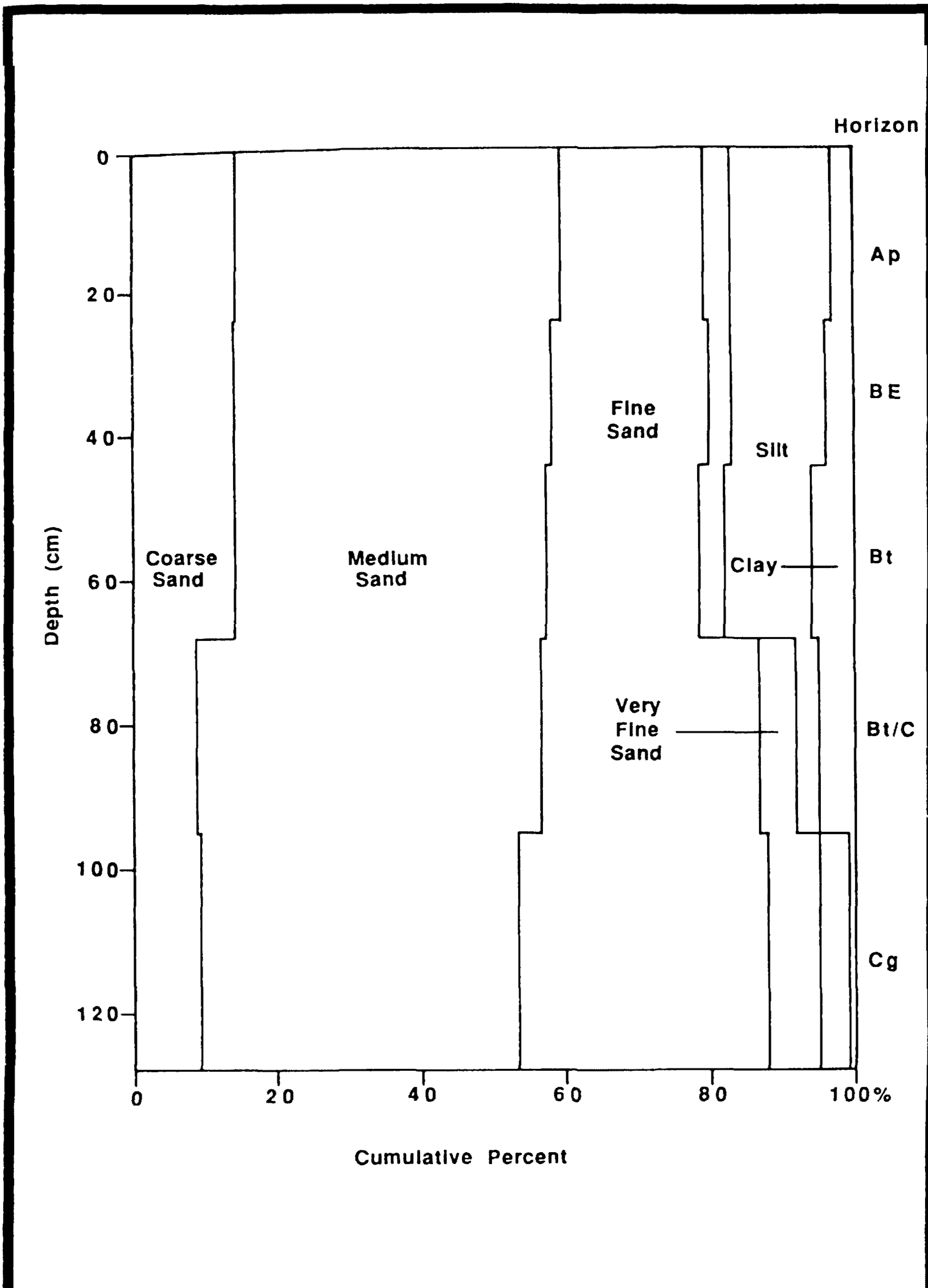


FIGURE 6: Distribution of Soil Particle Size With Depth, Excavation Unit 49

In terms of soil genesis, it is unclear why the argillic horizons occur in disrupted forms. The argillic bodies may have originally formed this way as a result of weathering mechanisms limited by the wet, sandy conditions of the site, or they may have undergone partial destruction since forming. Whatever the cause of the disruption, however, the argillic horizons are strongly developed, implying that the site landscape has remained stable probably since the late Pleistocene (Wagner 1990).

Although old subsoil horizons are indicative of essentially stable landscape conditions throughout the Holocene, the uppermost soil layers clearly have been susceptible to some modifications. This is apparent in the shallow burial of cultural features, and would be expected in any occurrence of very sandy soils. Because of the higher incidence of tree fall as well as insect and animal burrowing in sandy soils, surface horizons undergo more frequent mixing than occurs in finer textured soils. Local aeolian activity as well as occasional flooding could also account for minor modifications to the site surface (Wagner 1990).

The particle size trends (see Figures 5 and 6) do not indicate any lithological discontinuities in either of the two profiles. This suggests that artifact burial was primarily accomplished either through very localized reworking of the site soils or through the introduction of new materials identical in composition to those already on the site. The latter explanation seems less likely, although if introduced under sufficiently gradual rates, even different materials could be partially disguised through the blending action of pedoturbation processes (Wagner 1990).

Soil chemistry tests were completed for 40 soil samples, of which 35 were taken from within Area 3, and 5 were taken from off-site control locations. The control sample locations are shown in Figure 7. The standard battery of tests (Table 2) included acidity (soil pH), organic matter, phosphorous, potassium, magnesium, and calcium. In some situations, soil chemistry has been used to successfully delineate activity areas within archaeological sites and to assist in environmental reconstruction. Elevated phosphorous values may be indicative of high amounts of fertilizer, animal and human waste, ash, etc., and archaeological occupation sites frequently exhibit a higher concentration of phosphorous than adjacent, unoccupied areas. The amount of calcium in soils may be related to a variety of factors, including soil fertilizers that contain lime, and oyster shell.

The on-site tested samples are primarily representative of features identified in undisturbed subsoil contexts, while the control samples mostly represent surface horizon soils. The pH values (mean=4.5) are indicative of strongly acidic soils throughout the site and surrounding area. However, many of the extreme (minimum and maximum) values for phosphorous, potassium, magnesium and calcium were obtained from the control samples, suggesting significantly different conditions away from the Area 3 occupation locus. Within Area 3, the chemistry analysis shows relatively little variation, except for an unusually high value for calcium in Unit 79. The reason for the elevated calcium value in this area is not understood.

D. FLORA AND FAUNA

The Indian Creek Site occupies a setting that is marginal between the Oak-Chestnut Forest and the Oak-Pine Forest regions as defined by Braun (1950). The Oak-Chestnut Forest region extends from the Ridge and Valley through the Blue Ridge and Piedmont physiographic provinces and it extends for a short distance from the Piedmont into the northern portion of Maryland's Coastal Plain. The remainder of the Maryland Coastal Plain is within the Oak-Pine Forest region. The boundary between the two forest regions is not well defined, but the Oak-Chestnut vegetation is dominant within the Wicomico terrace; therefore, the Oak-Chestnut vegetation should be considered as the natural climax forest type for the upland areas in the Indian Creek Site vicinity. The principal species in the upland areas are chestnut, chestnut oak, beech, white oak, Spanish oak, sycamore, pignut hickory, red mulberry, wild black cherry, hackberry, and holly. The

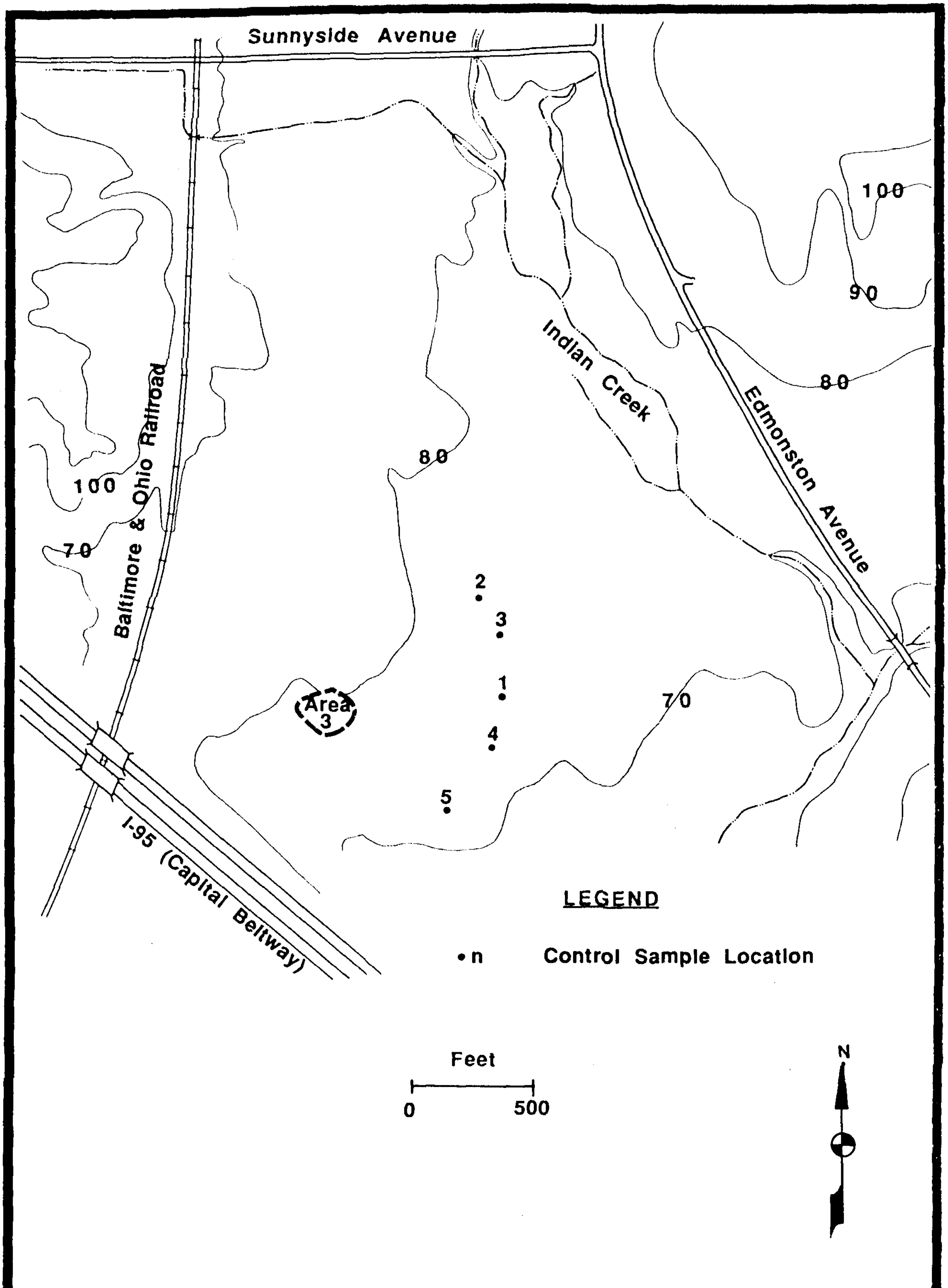


FIGURE 7: *Control Sample Locations*

TABLE 2. RESULTS OF SOIL CHEMISTRY ANALYSIS.

PROVENIENCE						CHEMICAL TESTS					
UNIT	LVL.	STR.	FT.	FLVL.	QUAD	Org.%	P	K	Mg	Ca	pH
52	2	B	7	1	NE	0.4	21	11	6	30	4.6
54	2	B	8	1	NE	0.2	25	7	5	20	4.5
58	2	B	10	1	SE	0.2	24	7	3	20	4.5
62	2	B	9	1	SW	0.2	22	7	2	10	4.5
62	3	B	9	2	SW	0.3	21	7	4	10	4.4
66	2	B	13	1	NE	0.3	37	8	4	20	4.5
67	2	B	14	1	SW	0.3	45	6	3	20	4.6
69	2	B	.	.	NE	0.5	27	7	4	10	4.4
73	2	B	12	1	NE	0.7	58	8	4	20	4.2
73	3	B	12	2	NE	0.3	57	5	3	20	4.4
77	2	B	15	1	SW	0.5	36	17	9	40	4.7
78	3	B	16	1	NW	0.3	28	11	10	70	4.5
79	2	B	.	.	NE	0.6	49	28	6	370	5.9
89	2	B	17	1	SE	0.5	36	6	3	20	4.4
91	2	B	.	.	NE	0.6	65	16	7	50	4.6
98	2	B	18	1	NE	0.5	64	9	4	30	4.6
103	2	B	.	.	NE	0.5	63	5	1	20	4.4
115	2	B	19	1	NE	0.4	34	7	2	20	4.4
119	2	B	.	.	NE	0.9	20	7	3	20	4.3
122	2	B	20	1	NW	0.3	44	11	5	40	4.8
122	2	B	21	1	SE	0.6	48	7	4	20	4.6
124	3	B	23	1	NW	0.4	24	9	4	20	4.4
128	2	B	25	1	NW	0.3	36	7	1	30	4.6
128	2	B	26	1	SW	0.4	34	8	2	40	4.5
129	3	B	36	1	SW	0.2	28	7	2	30	4.5
136	2	B	33	1	NW	0.7	61	9	5	30	4.4
136	3	B	35	1	SE	0.4	43	4	3	20	4.3
137	3	B	32	1	NE	0.2	42	6	3	30	4.5
137	3	B	34	1	SW	0.5	32	6	3	20	4.5
141	2	B	28	1	NE	0.4	36	5	3	20	4.4
143	2	B	31	1	SE	0.4	32	7	5	30	4.5
144	3	B	29	1	SE	0.6	40	4	2	10	4.3
146	2	B	27	1	SW	0.5	24	6	4	10	4.5
153	2	B	30	1	SW	0.3	25	7	2	10	4.4
155	2	B	.	.	NE	0.6	21	8	1	20	4.6
Control 1		A				1.9	87	17	4	20	4.3
Control 2		A				4.5	5	10	14	70	4.0
Control 3		A				2.0	7	6	6	20	4.2
Control 4		A				3.2	5	10	8	20	3.9
Control 5		A				4.4	10	54	39	190	4.4
MEAN						0.8	35.77	9.641	5.051	38.21	4.5
MINIMUM						0.2	5	4	1	10	3.9
MAXIMUM						4.5	87	54	39	370	5.9
STANDARD DEVIATION						1.0	18.01	8.524	6.156	62.15	0.3

Chemical Tests: Org.%--percent of organic matter; P--available phosphorous; K--potassium; Mg--magnesium; Ca--calcium; pH--soil acidity.

climax bottomland forest in the site vicinity would be more similar to the Oak-Pine region, where the dominant species include river birch, black willow, cottonwood, sycamore, sweet gum, willow oak, white elm, winged elm, red maple, tuliptree, and ash. In the Maryland Coastal Plain, wetland forests are particularly well developed, both in flat upland interfluvial areas and in streamside settings. Within the low-lying forested wetlands, sweetgum is the dominant forest element, and it is frequently associated with red maple, willow oak, pin oak, and tuliptree (Braun 1950).

The Indian Creek floodplain is an extensive forested wetland habitat, and the area at the confluence of Indian Creek and Beaverdam Creek contains hundreds of acres of wetlands, defined on the basis of hydrology, hydric soils, and vegetation. The wetland habitat occurs primarily in association with areas of Bibb silt loam and Johnston silt loam, and the Indian Creek Site occupies a slightly elevated terrace above the wetland.

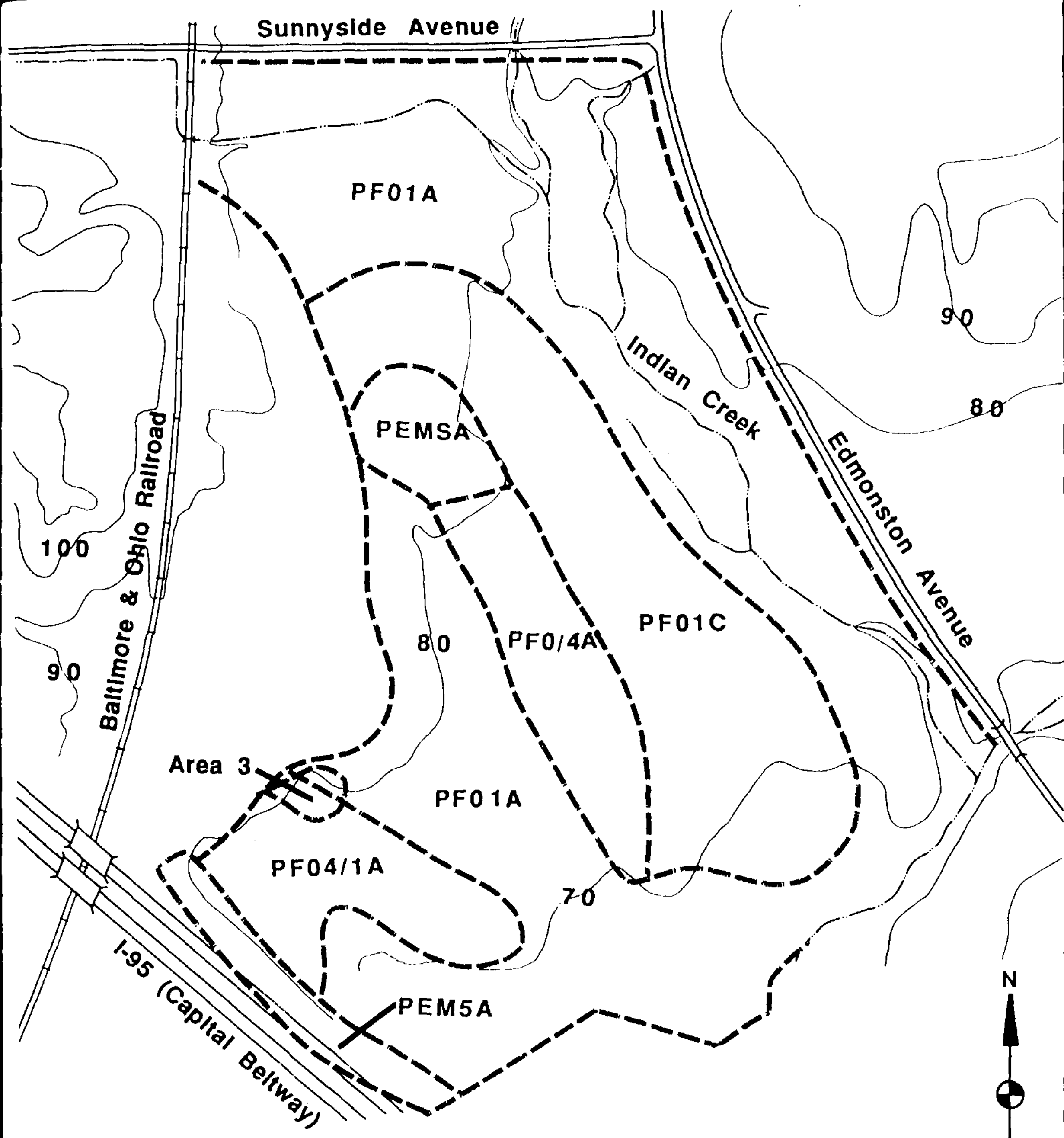
At the time of the archaeological excavations, Area 3 was characterized by a mixed deciduous and coniferous forest environment. Historically, the site area had been cleared and cultivated, but it had been permitted to revert to a reforested condition. Virtually the entire forested portion of the Greenbelt Storage Yard project vicinity falls within the wooded swamp category of forested wetlands. This wetland category is characterized by forested wetlands that are subject to seasonal saturation to the ground surface or flooding by as much as a foot of water (Magee 1981). A wetlands study undertaken by WMATA for the Greenbelt Yard project area and vicinity identified an extensive wooded swamp environment centered on the Indian Creek floodplain and low terraces (Figure 8). According to the WMATA wetlands study, Area 3 falls within a mixed broad-leaved deciduous and needle-leaved deciduous area that is subject to temporary flooding (WMATA 1988).

The dominant forest elements in the Area 3 vicinity were pitch pine, sweet gum, red maple, holly, American beech, tulip poplar, black cherry, sweetbay magnolia, willow oak, swamp chestnut oak, pin oak, white oak, and holly. The understory included spicebush, greenbriar, highbush blueberry, and winterberry. Ground cover at Area 3 consisted primarily of onion grass, poison ivy, and various briars. The wetland areas adjacent to Area 3 had a ground cover dominated by skunk cabbage and various ferns and mosses (WMATA 1988).

The prehistoric fauna in the site vicinity was much more diverse and abundant than at present. It is assumed that the extensive bottomland environments centered on Indian Creek would have supported a wide variety of fauna and flora that could have been exploited by aboriginal populations. The terrestrial animals that inhabited the region at the time of historic contact included white-tailed deer, black bear, porcupine, squirrel, chipmunk, woodchuck, turtle, weasel, skunk, fox, wolf, cougar, raccoon, opossum, muskrat, otter, mink, beaver, turkey, shrew, rabbit, and bobcat (Turner 1976, 1978).

E. PALEOENVIRONMENT

Given the widespread evidence of human occupation of the Middle Atlantic Coastal Plain beginning as early as the Late Pleistocene, a reconstruction of the regional environmental history should consider at least the last 11,000 years. Analysis of fossil pollens has provided the most direct method for inferring past environmental conditions. Paleoclimatic conditions can be inferred from fossil pollen evidence because of the ecological relationship that exists between biotic communities and their environment. The analysis of fossil pollen is used to determine the composition of past vegetational communities, and using the knowledge of the present relation of climatic variables such as temperature and moisture to certain plant species and genera, past climatic conditions are inferred. The concept of plant succession is the principal technique for determining past changes in vegetation and, by inference, climate (Ogden 1965:488).



KEY TO WETLAND TYPES

PF01A	Palustrine Forested Broad-Leaved Deciduous, Temporarily Flooded
PF01C	Palustrine Forested Broad-Leaved Deciduous, Seasonally Flooded and Seasonally Saturated
PF04/1A	Palustrine Forested Needle-Leaved Deciduous/Broad-Leaved, Temporarily Flooded
PEM5A	Palustrine Emergent Narrow-Leaved Persistent, Temporarily Flooded

FIGURE 8: Distribution of Wetlands SOURCE: WMATA, 1980

During the Pleistocene epoch, a series of massive continental glaciers advanced and retreated over much of North America. Because vast amounts of water were incorporated into these ice sheets, the sea levels were 300 to 500 feet lower than at present. Segovia et al. (1980) analyzed a series of deep soil cores taken from the METRO crossing of the Anacostia River, from approximately Second and M streets, S.W. (District of Columbia), to near the Botanical Gardens; they concluded that the Anacostia's base level was some 250 feet below its present level and that the river formerly had a much higher discharge. During the Pleistocene epoch, the ancestral Indian Creek, located within the Anacostia River drainage, presumably would also have been characterized by a higher discharge, a steeper channel profile, and a more linear channel pattern, rather than its present braided or anastomosing pattern (Leopold et al. 1964).

The generally accepted marker for the end of the Pleistocene is the beginning of the glacial retreat immediately following the Valders substage maximum, which has been dated radiometrically to about 10,500 years BP. The clustering of a large world-wide sample of radiocarbon dates indicated that an abrupt climatic shift occurred over a period of a few decades, marking the beginning of the present Holocene epoch (Bryson, et al. 1970). With the global warming of the Holocene, sea levels rose with the release of the glacial meltwater. The ancestral Susquehanna River Valley was drowned, and the rising sea water eventually formed the estuarine environments of the Chesapeake Bay. By the same process, estuarine environments were formed in the lower Potomac and Anacostia River valleys. During the late Pleistocene, the Indian Creek Site would have been hundreds of miles from the sea, while presently it is only a few miles from the estuarine environment of the lower Anacostia River.

Pollen studies in North America (Sears 1942; Deevey 1943) defined a sequence of five postglacial climatic episodes. The Danish Blytt-Sernander terminology for pollen zones and climatic episodes is in general use in North America. In this system, the following terminology has been applied to the succession of climatic episodes and pollen zones:

Climatic Episode	Pollen Zone
Preboreal	Spruce-Fir
Boreal	Pine
Atlantic	Oak-Hemlock
Subboreal	Oak-Hickory
Sub-Atlantic	Oak-Chestnut

In practice, the Blytt-Sernander terminology has been applied to pollen profiles as well as climatic periods. Although the relationship between climate and vegetation is well established, the use of a single terminology is somewhat confusing because climatic episodes are dated on an absolute scale while pollen profiles provide a more relative type of dating because of the lag in vegetative succession which is a function of latitude and elevation.

Based on detailed study of the Thunderbird and related sites in the Shenandoah Valley, Carbone (1976) has provided a general model of the Middle Atlantic paleoenvironmental conditions from the Late Pleistocene to the present. Custer (1984) has updated Carbone's work, emphasizing the conditions in the Coastal Plain, using a number of more recently available pollen studies. A general model for the Middle Atlantic Coastal Plain (Table 3) has been developed on the basis of these studies and it may be used to characterize the regional environmental conditions for the Late Pleistocene and Holocene epochs.

Carbone (1976), using pollen data from Hack Pond, a site in the Shenandoah Valley, estimated a series of key climatic variables from the late Pleistocene to recent times. These estimates (Figure 9) clearly delineate the abrupt rise in temperature and decline in moisture that occurred at the close of the Pleistocene. Again using the Hack Pond pollen data, Figure 10 portrays the estimated duration of air masses from the Late Glacial period to the present.

TABLE 3. SUMMARY OF PALEOCLIMATIC EPISODES, MIDDLE ATLANTIC REGION.

EPISODE	APPROXIMATE DATES	GENERAL CHARACTERISTICS
Late Glacial	10,000-8000 BC	Climatic conditions were cooler and moister than at present, but the gradual warming led to the retreat of the Laurentide ice sheet; regional environment characterized by a boreal forest, dominated by spruce; deer, elk, and moose were the largest game animals, but other cold-adapted species were also present.
Preboreal/Boreal	8000-6500 BC	Increase in duration of southern air masses; slight increase in temperature and reduction of cloudiness; reduction of open grasslands and spread of forests dominated by pine and northern hardwoods.
Atlantic	6500-3100 BC	Sharp reduction in duration of Arctic air masses; appearance of modern environmental conditions--early part of period characterized as warm and humid, while later part was increasingly dry; full appearance of modern environment with warm, moist conditions; continental climate with marked seasonal differences; widespread dominance of mesic oak-hemlock forests; establishment of modern faunal communities; expansion of deer and turkey populations.
Subboreal	3100-800 BC	Warm, dry climate (mid-postglacial xerothermic, circa 2350-200 BC) at the beginning of the episode, followed by gradually increasing moisture and cooling temperatures; dry conditions led to spread of grasslands and reduction of oak-dominated forests; reduction in the rate of sea level rise permits florescence of estuarine environments in coastal areas
Sub-Atlantic	800 BC to present	Cooling reduced the moisture stress of the Sub-Boreal, leading to essentially modern conditions; upland forests include a mix of coniferous and deciduous species.

Source: Carbone (1976); Custer (1984).

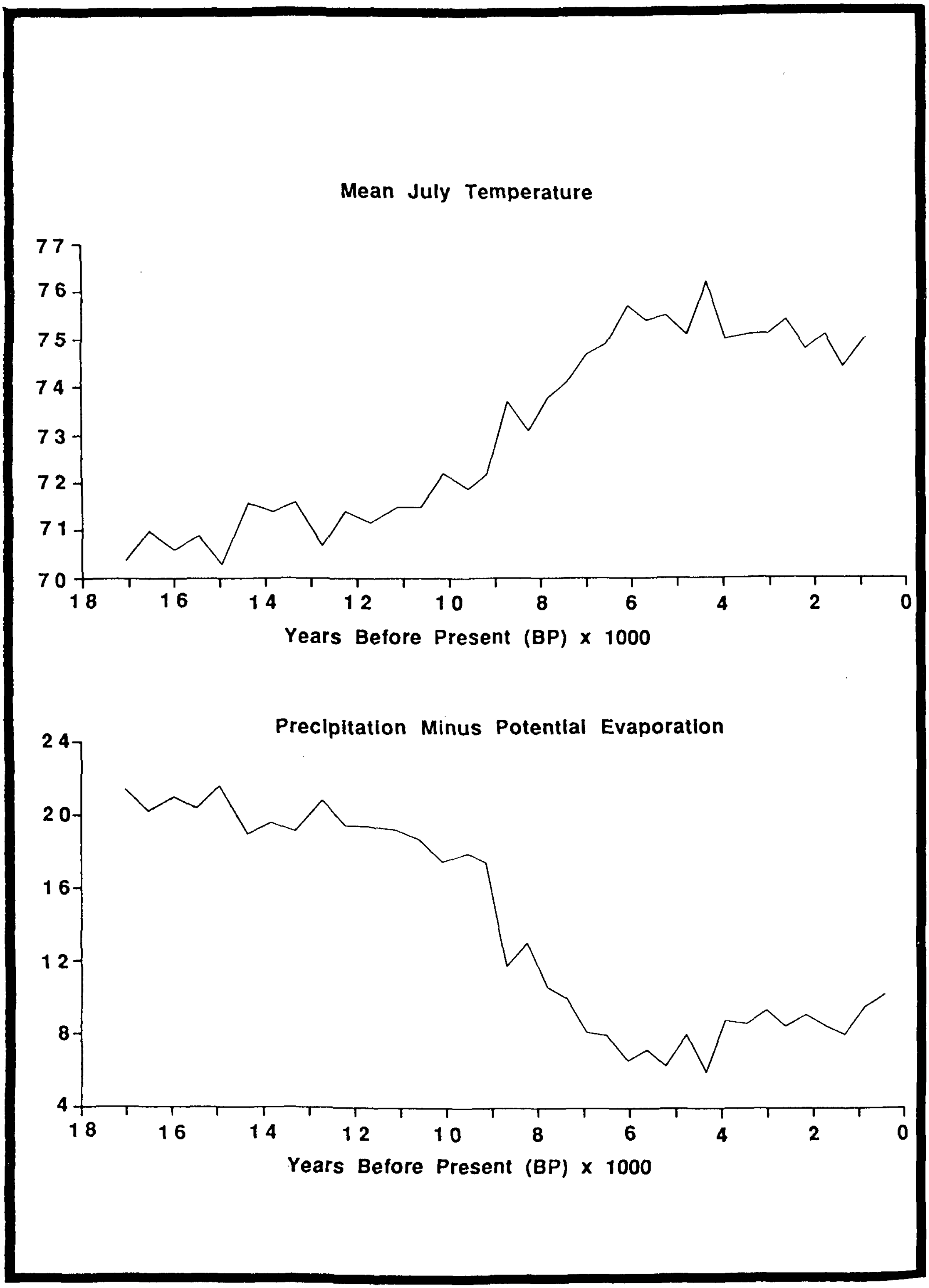


FIGURE 9: **Paleoclimatic Parameter Estimates** SOURCE: Hack Pond data from Carbone (1976).

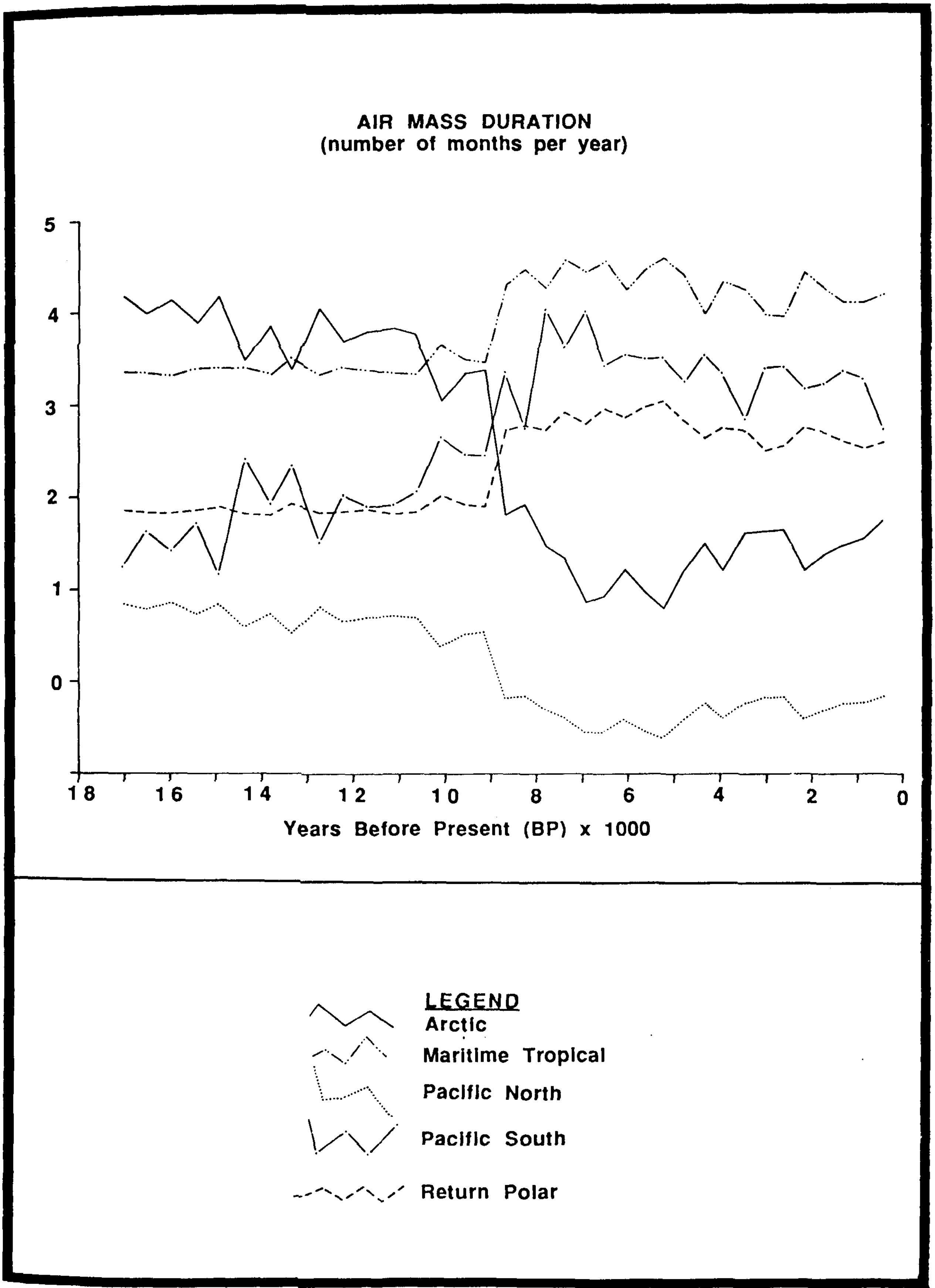


FIGURE 10: **Paleoclimatic Air Mass Duration Estimates**

SOURCE: Hack Pond data from Carbone (1976).

During the Late Glacial period, the climatic patterns in the region were controlled to a large extent by the presence of the Laurentide ice sheet. The ice sheet would have prevented incursions of northern Arctic air in the lower continental region, thereby allowing somewhat warmer winter temperatures in the midcontinental area. Strong Pacific westerlies would have prevailed, and the proximity of the maritime tropical air mass to the edge of the ice sheet would have created a zone of intense frontal activity in the northern unglaciated portions of the Middle Atlantic region. Available pollen evidence indicates that the dominant forest elements were spruce and pine and that nonarboreal flora, such as grasses, shrubs, and herbs, were also present. This may be indicative of a mosaic of vegetational habitats, including open grasslands, coniferous forests, and deciduous floodplain forests. The Full Glacial and Late Glacial fauna would have included a variety of extinct and currently existing animals; some of the larger animals that would have been present include browsing mastodon, mammoth, horse, camel, caribou and white-tailed deer, while the smaller animals would have included wolf, skunk, otter, weasel, fox, moles, shrews, squirrels, lemmings, and mice (Carbone 1976; Custer 1984).

A rapid shift in the climatic patterns that occurred circa 10,500 BP marked the onset of the Preboreal/Boreal episodes. This was marked by an increase in the duration of southern air masses, an increase in temperatures, and an increase in available sunshine brought about by a reduction in cloudiness. By 8000 years BP, the glacial ice mass was still large enough to influence air circulation patterns, and strong westerly winds still prevailed. Regional vegetation patterns were characterized by the reduction and eventual closure of open grassy habitats and the replacement of spruce by pine or deciduous species. The establishment of northern hardwood forests occurred in the Coastal Plain during the Preboreal episode. The increased temperatures and reduction of grassland led to a northern retreat of animals adapted to grassland and forest-edge habitats, and this Preboreal/Boreal episode as a whole was characterized by a reduction in biological carrying capacity. The disappearance of the Late Glacial vegetational mosaic may have heightened the importance of wetland areas to animals such as deer, elk, and moose (Carbone 1976; Custer 1984).

A sharp reduction in the duration of Arctic air masses occurred during the Atlantic episode, allowing a continuous warming trend that was accompanied by an increase in precipitation. Regional vegetation patterns were characterized by an initial expansion of hemlock and later of oak. The warm, wet conditions of this episode may have fostered the expansion of wetland areas. Modern fauna were established during this episode, and the principal animals of importance to human populations were turkey and deer (Carbone 1976; Custer 1984).

The postglacial warming trend culminated during the Subboreal episode. Regionally, the xerothermic conditions led to an expansion of grasslands and the dominance of an oak-hickory forest type. Squirrel and turkey populations would have benefited from the dominance of nut-bearing trees, while species intolerant of dry habitats would have declined. Amelioration of the xerothermic conditions at the close of the Subboreal permitted the establishment of modern forest conditions. The reduction in the rate of sea level rise that occurred during the Subboreal permitted the establishment of stable estuarine environments in the tidal areas of the Coastal Plain. With the formation of tidal wetland marshes adjacent to the Chesapeake Bay and its tributaries, the Maryland Coastal Plain reached its peak carrying capacity, replete with waterfowl, shellfish, and marine fish (Carbone 1976; Custer 1984; Wesler 1985). Essentially modern environmental conditions continued through the Sub-Atlantic episode, with minor climatic fluctuations.

The environmental character of the immediate site vicinity would have varied according to local altitude, lithology, soils, solar exposure, and drainage. Dent (1985) has demonstrated that many distinct plant communities may exist within a geographically restricted area, depending on variations in altitude, exposure to sunlight, and availability of water. The paleoclimatic episodes outlined in Table 3 should be viewed as indicative of broad regional conditions, with the understanding that the local environment of the Indian Creek floodplain would have had a distinctive character.

It is possible to infer the vegetative patterns for the Indian Creek Site vicinity in some detail, using a pollen core obtained from an abandoned stream channel located roughly 400 feet to the northwest of Area 3. The abandoned stream channel was identified during the geomorphological investigations ancillary to the archaeological excavations, and the channel fill was composed of a black organic peat with excellent pollen preservation. Several cores were extracted from this location, designated "Dan's Bog," of which the most complete (designated "DB-6") measured 129 centimeters.

Seven pollen zones were defined (Table 4), based on pollen percentages and influxes of individual species (Brush 1990). Figure 11 illustrates the pollen influx profile for the DB-6 core. The chronology of the pollen zones was accomplished by calculation of sedimentation rates between dated horizons. Radiocarbon dates from the DB-6 core are as follows:

Depth (cm)	Age (radiocarbon years BP)
25-26	1770 ± 140 (Beta 42020)
42-43	3860 ± 110 (Beta 42666)
75-76	7660 ± 160 (Beta 42667)
115-116	10,800 ± 200 (Beta 42668)
129-130	10,660 ± 90 (Beta 37871)

The dated samples were taken at the transitions between episodes, with the exception of the sample at 27 centimeters which was slightly lower than the transition between Zones 4 and 5 (22 centimeters). An additional date of 5140 ± 100 BP (Beta 37043) was obtained at a depth of 67 centimeters from another core sample from Dan's Bog, and this date provides an estimate for the transition between Zones 3 and 4. The most recent, agricultural horizon (Zone 7) corresponds to the historic period, and was defined by a rapid increase in ragweed *(Ambrosia)* pollen, which is an indicator of cultivated land.

The suite of dates indicates that the core provides a virtually complete record of the local vegetation during the Holocene epoch, thereby covering the entire prehistoric occupation of Area 3. The basal (129-130 centimeters) date of 10,660 ± 90 years BP is anomalous in that it is more recent than the date obtained at 115-116 centimeters. This anomaly is believed to have resulted from contamination while the core was physically extracted from the bog. The Late Glacial vegetation in the Indian Creek vicinity, represented by Zone 1, was dominated by pine *(Pinus)* and spruce *(Picea)*, with alder *(Alnus)* becoming more abundant toward the end of the period. Among the nonarboreal taxa, madder *(Rubiaceae)*, milkwort *(Polygala)* and composites *(Compositae)* are dominant. Cool, floodplain conditions are clearly indicated by the pollen record.

Zone 2 is marked by a major increase of birch *(Betula)* and a decrease of pine *(Pinus)* and spruce *(Picea)*, while alder *(Alnus)* decreases somewhat but remains plentiful. Oak *(Quercus)* increases in this zone but remains less plentiful than birch *(Betula)*. Goldenrod *(Solidago)* and arrowwood *(Viburnum)* are abundant among the nonarboreal taxa. Warming conditions are indicated by the increase of oak, and the abundance of goldenrod may be indicative of open areas within the local landscape. The initial aboriginal use of Area 3 occurred during this episode.

Continued warming conditions are indicated by the pollen composition of Zone 3, but this zone also includes evidence of much moister conditions. The reduction of pine and birch and the disappearance of spruce and fir *(Abies)* occur in this zone. Oak, hazelnut *(Corylus)*, and alder are the dominant arboreal species, and maple *(Acer)*, black gum *(Nyssa)*, beech *(Fagus)*, ash *(Fraxinus)*, and walnut *(Juglans)* are also present. Cinnamon-fern *(Osmunda)* is the dominant herbaceous species, and sedges *(Cyperaceae)* reach their peak in this zone. The warm, most

TABLE 4. HOLOCENE PALYNOLOGY OF THE INDIAN CREEK FLOODPLAIN BOG.

POLLEN ZONE	APPROXIMATE TIME PERIOD	POLLEN ASSEMBLAGE AND INFERRED ENVIRONMENTAL CONDITIONS
1	12,000(?) - 10,800 BP	Pine-Alder-Composite assemblage; cold climate; floodplain environment dominated by conifers (pine and spruce) and alder, with some herbaceous plants, primarily composites; hazelnut, ash and walnut present in moderate numbers; dominant nonarboreal taxa include madder and milkwort; blueberry, buckwheat, ragweed, arrowwood, wood-fern, cinnamon fern, and club moss also present.
2	10,800 - 7660 BP	Birch-Oak-Goldenrod assemblage; warming climatic conditions indicated by a dramatic increase in birch and decrease in spruce and pine; oak increases; alder decreases but remains plentiful; hazelnut, beech, ash and walnut present; wood-fern and cinnamon fern increase during this period; black gum and blueberry appear near the end of this period; landscape possibly has some open areas colonized by goldenrod.
3	7660 - 5000 BP	Oak-Hazelnut-Cinnamon Fern-Sedge assemblage; moist, warm conditions indicated by disappearance of spruce and fir and reduction of pine and birch; oak, hazelnut, and alder are the dominant arboreal species; maple, black gum, beech, ash and walnut are present but in low numbers; cinnamon fern is the dominant herbaceous species; sedges reach their climax and elderberry first appears during this period.
4	5000 - 3860 BP	Oak-Cinnamon Fern assemblage; warm, dry climatic conditions indicated by the dominance of oak and increases in hickory and pine; alder and birch decrease and hazelnut disappears with only sporadic occurrences in later zones; dominant nonarboreal species include cinnamon fern, which peaks during this period, and blueberry, elderberry, arrowwood, and buckwheat.
5	3860 - 1770 BP	Herbaceous assemblage; dramatic decrease of all tree pollen and influx of legumes, elderberry, blueberry, and arrowwood; oak is the dominant arboreal species; pollen assemblage is indicative of a landscape covered with herbaceous plants.
6	1770 - 350 BP	Ericaceae (blueberry, etc.) assemblage; continued reduction of arboreal species; Ericaceae increase but other herbaceous species disappear; cattail is present only during this interval; cooler climatic conditions.
7	350 BP - Present	Ragweed assemblage; historical conditions characterized by large-scale deforestation and cultivation.

Source: Brush (1990).

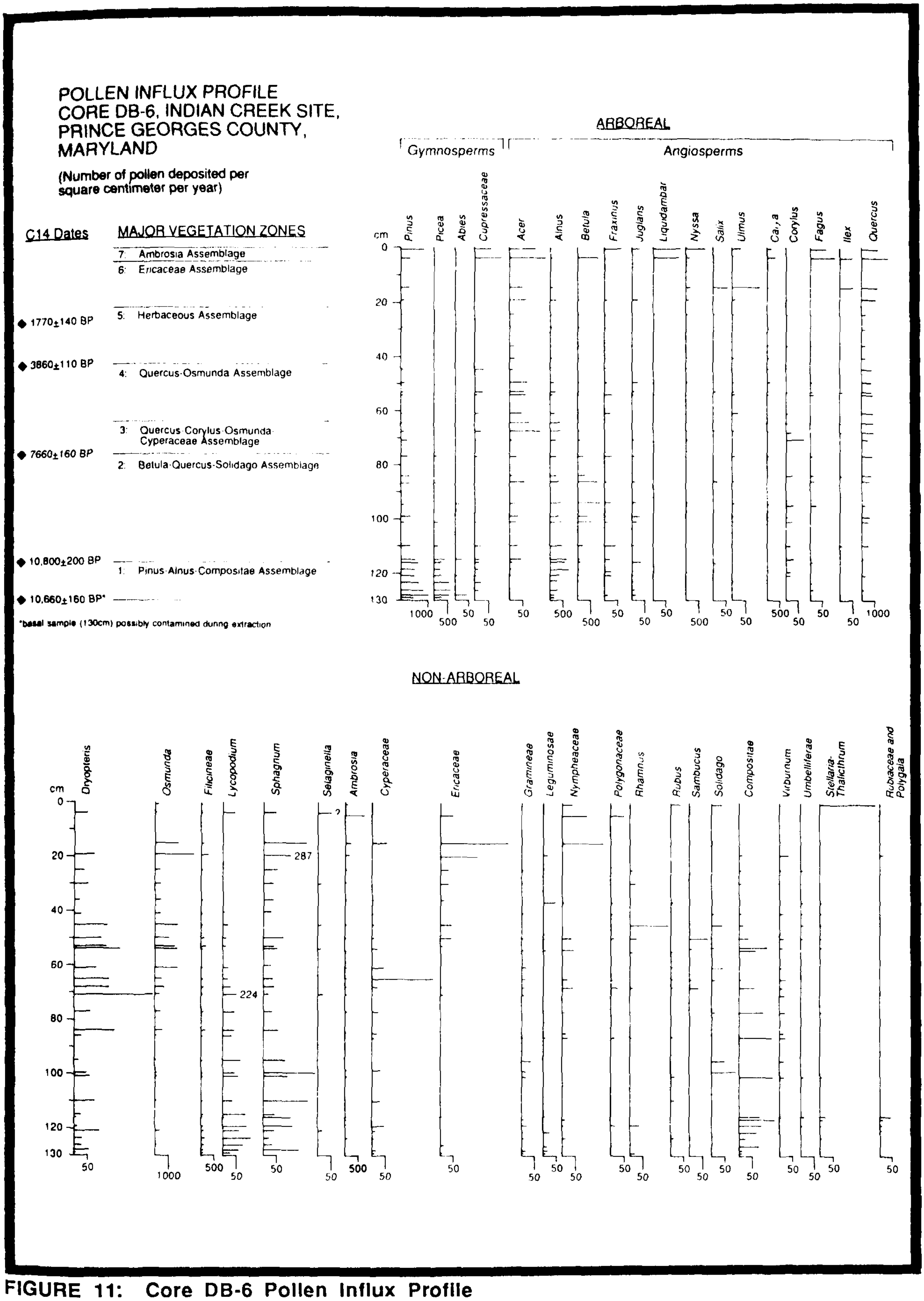


FIGURE 11: Core DB-6 Pollen Influx Profile

conditions indicated by Zone 3 appear to correspond to the early part of the Atlantic climatic episode.

In Zone 4, oak continues as the dominant arboreal species, and cinnamon-fern reaches its peak. Pine, hickory *(Carya)*, and walnut increase in this zone, while alder, birch, and hazelnut decrease. In addition to cinnamon-fern, abundant nonarboreal taxa include blueberry *(Ericaceae)* and elderberry *(Sambucus)*, while arrowwood and buckwheat *(Polygonaceae)* are present in moderate frequencies. The drier, mesic conditions of Zone 4 probably correspond to the mid-postglacial xerothermic conditions during the Subboreal climatic episode.

Zone 5 is marked by a major reduction of arboreal pollen and an expansion of herbaceous species. Oak accounts for the majority of the arboreal pollen, but in significantly decreased frequencies. Major influxes of the bean family *(Leguminosae)* and elderberry, together with moderate increases in blueberry, and arrowwood mark this zone.

Sub-Atlantic climatic conditions, characterized by the return of cooler, moister conditions, led to the reestablishment of mixed deciduous forests throughout the Middle Atlantic region. However, nonarboreal species continued to dominate the local environment in the Indian Creek vicinity until the historic period. Arboreal pollen remained at low levels in Zone 6, and many of the herbaceous taxa also disappeared. Members of the *Ericaceae* increased during this interval, possibly indicating the presence of heaths adapted to cool conditions. Cattail *(Typha)*, which is present exclusively in Zone 6, is also represented in moderate numbers. There is no evidence of aboriginal use of Area 3 after the onset of the environmental conditions represented by Zone 6.

IV. RESEARCH DESIGN

A. INTRODUCTION

This chapter presents a discussion of the research design that guided the data gathering, analysis, and interpretative efforts of the study. The research design was structured to address the research priorities outlined in Maryland's Comprehensive Historic Preservation Plan (HPP). Maryland's HPP provides an explicit statement of current information needs, organized according to the state's major physical regions and time/developmental periods. This document, which was developed according to the Department of the Interior's Resource Protection Planning Process (RP3) model, defines a number of themes or information needs which may be used as an interpretive framework or context for data collection and analysis. Themes for the prehistoric period include subsistence, settlement patterns, political organization, demography, religion, technology, and environmental adaptation (Maryland Historical Trust 1986:251-258).

During the preceding survey of the Greenbelt Storage Yard facility (LeeDecker et al. 1988), the primary research objective was to complete an inventory of all archaeological and historical properties within the area of proposed construction. Based on the Maryland HPP and consideration of the information likely to be obtained during a survey level of investigation, specific research questions were developed to provide an interpretive framework. These questions concerned prehistoric site distribution, the local availability of various natural resources, the character of prehistoric occupation of the study area, and historic land-use patterns.

As the archaeological investigations proceeded, the research focus changed in orientation from a general inquiry concerning the presence or absence of archaeological resources to a more focused, site-specific program of testing and evaluation. The initial survey demonstrated that the project area contained an extensive prehistoric site that had been utilized primarily during the Archaic period, circa 8000 BC to 1000 BC. As a result, it was possible not only to address issues pertaining to local prehistory, but also to formulate additional research questions of a more site-specific nature. The site-specific concerns that were addressed during the testing and evaluation program generally focused on chronology, identification of specific activities, evaluation of site formation processes and preservation factors, and determination of whether or not data were present at the site that might provide information pertinent to subsistence or environmental conditions.

The testing program carried out for Area 3 demonstrated that the site had the potential to provide information regarding a number of these themes, most notably subsistence, settlement patterns, technology, and environmental adaptation. The present data recovery program has been designed in such a way as to expand existing knowledge pertinent to contexts identified in the state plan. In addition to addressing the substantive, anthropological issues identified in the state plan, the present study addresses questions related to the most appropriate treatment of resources similar to the site under investigation. These latter issues pertain directly to future decisions regarding appropriate treatment (sampling design, methodology, etc.) of similar archaeological resources.

The following section provides a discussion of the principal prehistoric research issues that provided a focus for the archaeological excavations and data analysis. Concentrating on the Archaic period of prehistory, these issues include subsistence, settlement patterns, activity area reconstruction, technology, and environmental adaptation. The concluding section to this chapter outlines the data collection and analytical methods employed to address the research issues.

B. PROBLEM ORIENTATION AND RESEARCH CONTEXT

1. Subsistence

The subsistence theme deals primarily with dietary composition and food procurement strategies. Archaic cultures in the eastern United States are generally characterized by a subsistence economy that combined hunting of game animals and gathering of plant foods. Archaeologists have used the notion of the Archaic period or developmental stage since the 1930s, and it has generally been applied to cultures that lack agriculture, fired clay ceramics, and permanent settlements. The beginning of the Archaic stage generally coincides with the onset of modern (Holocene) climatic conditions at the end of the Pleistocene glacial episodes (Custer 1990).

It is believed that human populations gradually increased during the Archaic period, and Caldwell (1958) developed the model of "primary forest efficiency" which posited an increasing familiarity with the environment that allowed more efficient exploitation of seasonally abundant food resources within various micro-habitats of the eastern deciduous forest. Cleland's (1976) "focal-diffuse model" has also been widely used in the interpretation of the changes in subsistence patterns that occurred during the Archaic period. Paleoindian technologies, characterized by a tool kit that seems oriented quite narrowly toward exploitation of herd animals, are viewed as focal adaptations; the ensuing Archaic adaptations, with a greater variety of site types and tool kits, are seen as diffuse adaptations, with a subsistence base that included a broader variety of floral and faunal resources. Food production, best exemplified by the intensive use of corn and other domesticates, is seen as a Late Focal adaptation, according to Cleland's model.

Archaeological techniques are generally suited to the reconstruction of subsistence patterns by direct identification of dietary refuse such as bone or botanical material. However, the preservation of bone and botanical material is unusual for sites dating to the Archaic period, particularly open sites where cultural deposits are limited to surface and near surface contexts. Faunal remains (bone and shell) are more frequently recovered from Archaic sites than are plant foods, although sophisticated techniques for the recovery of floral remains are not in general use. Archaic site excavations in the Middle Atlantic region and the wider Eastern Woodlands area have seldom produced well-preserved archaeobotanical assemblages, and the current understanding of Early Archaic subsistence largely emphasizes the importance of animal foods. While the preservation of either floral or faunal material is infrequent, the recovery of botanical material is much more unusual than the recovery of bone.

Wesler (1985:219) has called attention to the lack of direct subsistence information in Maryland and noted that the existing models of subsistence behavior are based on the inferred environmental settings of individual sites. As a result of the almost complete lack of direct subsistence information in Maryland and the surrounding Middle Atlantic region, a context for interpretation of subsistence behavior at the Indian Creek Site must be carried out by reference to a few sites scattered throughout the Eastern Woodland area.

An Archaic site with an extensive bifurcate point tradition was excavated at the Rose Island Site, along the Little Tennessee River in eastern Tennessee (Chapman 1975). The Rose Island Site was interpreted as a base camp for one or more bands that occupied the site from the summer through the early winter. Subsistence data at the Rose Island Site were admittedly quite meager, and were supported by direct archaeological evidence only for the fall. Identifiable plant food remains associated with the bifurcate phase occupation at the Rose Island site were limited to hickory nut, acorn, and honey locust seeds; of these, hickory nut and acorn comprised 99 percent of the total sample by weight (Chapman 1975).

Like the Indian Creek Site presently under investigation, the Eva Site in Benton County, Tennessee, was utilized throughout the Archaic period. This site contained an abundance of fauna (deer, bear, raccoon, opossum, beaver, rabbit, muskrat, turkey, turtle, drumfish, etc.) but no archaeobotanical material was recovered. Analysis of the dietary remains indicated a heavy dependence on deer during the Early Archaic, but that the Late Archaic diet was supplemented by a wider variety of mammalian species as well as mollusc (Lewis and Lewis 1961).

At many sites with Early and Middle Archaic occupations, the complete absence of food remains is typical (e.g., Starbuck and Bolian 1980), and investigators must rely on indirect evidence to interpret subsistence behavior. For example, excavations at the deeply stratified St. Albans Site in Kanawha County, West Virginia, have produced indirect evidence that plant foods may have been an important element of Archaic subsistence strategy. In particular, the recovery of hoes or grubbing tools in association with Kirk and Kanawha levels suggests that plant foods were at least a dietary supplement during the Early Archaic period (Broyles 1971).

The recovery of archaeobotanical remains is, in a large measure, dependent on the application of flotation recovery techniques. Flotation recovery has been successful at a few Middle Atlantic sites, leading some investigators (e.g., Kauffman and Dent 1982) to challenge the prevailing view that Paleoindian and Early Archaic subsistence behaviors were almost wholly dominated by hunting. Botanical data present a unique set of interpretive problems, and it does not necessarily follow that all seeds, charred or otherwise, recovered from archaeological contexts represent plants that were consumed or intentionally used by the site inhabitants (Holt in press; Keepax 1977; Minnis 1981; Moeller 1986; Smith 1985).

Relative to the Middle Atlantic region, botanical remains have been more frequently reported from sites in the Southeast, particularly from rockshelters and deeply buried sites. Because the Archaic tradition encompasses the entire Eastern Woodlands area, it is assumed that archaeobotanical data from the Southeast are in some measure applicable to the Middle Atlantic. Yarnell and Black, using data from 60 sites in the Southeast (1985), have compiled an important database pertaining to the prehistoric use of plant foods. First, there is widespread evidence that nuts (hickory, walnut, acorn, etc.), greens (e.g., purslane and pokeweed), fleshy fruits, small grains, and seeds were used throughout the Archaic and Woodland Periods. Seed-to-Nutshell ratios (computed as the number of seeds per 100 grams of nutshell) showed a steady increase through the Archaic, Early Woodland and Middle Woodland periods, but dropped during the Late Woodland. Yarnell and Black also observed that the seeds of plants used for greens (purslane and pokeweed) declined after the Middle Archaic, while the numbers of small-grain-forb seeds (e.g., chenopod and amaranth) increased significantly during the Late Archaic and Woodland periods. Given these trends, they suggest that forb-grain utilization during the Late Archaic may have derived from the initial use of plants as greens (Yarnell and Black 1985).

Late Archaic subsistence patterns are better understood than those of the Early and Middle Archaic, and existing models indicate reliance on a broader diversity of species as well as greater reliance on riverine resources. In the Outer Coastal Plain of the Middle Atlantic, shellfish gathering became increasingly important during the Late Archaic, and the oyster shell heaps found along the Lower Potomac River and its tributaries were first exploited intensively during the Late Archaic (Waselkov 1982). Exploitation of riverine resources, particularly anadromous fish and shellfish, is also thought to have intensified in the Coastal Plain during the Late Archaic (Custer 1984; Gardner 1987).

Elsewhere in the Eastern Woodlands area, an intensified use of riverine resources is evident by the use of freshwater mussel at sites in the Ohio River drainage (Winters 1974). A few excavated sites in the midwest riverine region have provided well-preserved faunal assemblages that indicate a broad range of species in the diet. White-tailed deer appears to have been the most important game animal in the Late Archaic diet; other species include raccoon, beaver, elk, opossum, rabbit, porcupine, turkey, squirrel, woodchuck, muskrat, skunk otter, bear, chipmunk, and various reptiles (snake, turtle, frog, etc.), fish, shellfish, and waterfowl (Cook 1976; Parmalee 1969)

2. Settlement Patterns

The settlement pattern theme pertains to a culture's adaptation to the landscape. When viewed from a regional perspective, settlement pattern studies examine the distribution of communities or sites across the landscape. Regional settlement patterns are perhaps best viewed from the perspective of cultural ecology, a theoretical framework that seeks to understand specific cultural features and adaptive patterns, with particular attention to those aspects of culture that are closely related to the utilization of the environment (Steward 1955:36-37). The cultural ecology approach is particularly well suited to the study of hunter-gatherer cultures, because many important aspects of these cultures are closely related to the biophysical environment. Archaeologists have used other models for the study of macrosettlement patterns, including central place theory, catchment analysis, etc. (Roper 1979). Settlement patterns may also be examined at the micro-scale, i.e., by the analysis of patterning within individual sites; in the present study, microsettlement patterns have been treated separately from regional settlement patterns (see discussion of activity area reconstruction below).

Eastern Archaic settlement patterns are generally characterized by seasonal movements through a series of habitats that provide various plant and animal foods at different times of the year. Different settlement types, distinguished by the group size and activities, are established during the annual round. Therefore, an examination of settlement patterns requires an understanding of the environment, including the regional distribution of micro-habitats where important plant or animal food species may be clustered at certain seasons of the year. In addition to biotic resources, other essential elements of the physical environment include mineral resources, topography, and landforms (Butzer 1982).

Optimal foraging strategy theories have become increasingly used in hunter-gatherer research. Derived from classic evolutionary theory and ecology, optimal foraging strategy models describe behavioral patterns that provide the greatest net rate of energy acquisition. These models generally examine the mathematical relationship between the energy yield and the time required to capture a particular unit of energy, using cost-benefit analyses to examine various behavioral patterns. Energy is generally defined in terms of food value (e.g., calories, protein, etc.), although specific nutritional components (e.g, vitamins and essential minerals) and dietary breadth are also important. Behavioral patterns that may be evaluated in the cost-benefit analyses include dietary breadth (i.e., whether or not it is advantageous to add an item to the diet), optimal foraging space (i.e., the size of the group territory), optimal feeding period (i.e., the timing or scheduling of feeding behaviors) and optimal foraging group size (i.e., the circumstances that favor the formation or dissolution of groups). Depending on the range of food types in the diet, forager strategies may be categorized as specialist or generalist, a distinction that is closely related to Cleland's (1976) focal-diffuse model (Winterhalder 1981).

Regardless of specific features of the environment, the spatial distribution of key resources in the environment may be described as patchy or uniform. A patchy distribution refers to a discontinuous or localized pattern as opposed to a more homogeneous or even distribution. The term "grain" is used to describe patchiness in terms of geographic scale; that is, the patchiness of environmental features must be viewed relative to the range or territory size of the foraging group. A fine-grained foraging strategy refers to the exploitation of specific resources or patches according to their relative abundance within the immediate environment. A coarse-grained approach refers to a more selective or focused exploitation of specific resources or patches within a heterogeneous environment (Winterhalder 1981).

Using ethnographic and archaeological research, Binford (1980) has examined hunter-gatherer settlement patterns and identified distinct adaptive strategies which he terms foraging and collecting. The foraging strategy involves seasonal moves of the entire social group between residential base camps, coupled with daily collection and consumption of foods within range of the base camp. Foragers normally have a high degree of residential mobility and a daily food procurement strategy, with infrequent use of food storage technology, and the size of the group may vary considerably throughout the annual cycle. The typical foraging settlement pattern includes only two types of sites, the residential base where most processing, consumption, and maintenance activities take place, and location sites where foods and other resources are gathered. Populations utilizing the collector strategy supply their needs for critical resources by means of specially organized task groups that establish field camps or stations away from the group's primary residential base. Binford views this strategy, which is exemplified by the Nunamuit Eskimo, as an adaptation to an environment where critical resources are separated by relatively wide distances. Collectors employ food storage technology, and they may process foods at the collection station to facilitate its transport to consumers at the residential base. In addition to the residential base, site types associated with the collector settlement pattern include the field camp, the station and the cache. Field camps are temporary bases for task groups, while stations are locations where collectors gather information, such as game movements. Caches are temporary storage loci for bulky resources (Binford 1980).

In a large measure, archaeological settlement pattern studies in the Middle Atlantic region have been based on regional surveys and museum collections, so that while there is some understanding of the varying use of specific resource zones, the understanding of individual site types is relatively superficial. These models are robust in the sense that they are derived from large data sets, but they suffer from the fact that very few sites have been excavated to an extent sufficient to render them understandable in the context of their immediate environmental setting.

In the Middle Atlantic region, the most comprehensive settlement pattern studies have been completed by William M. Gardner and his associates. The principal focus of Gardner's research has been the Paleoindian and Early Archaic periods. Based on extensive research in the Shenandoah Valley of Virginia, Gardner has suggested that a significant shift in the settlement pattern occurred during the Early Archaic period, accompanying the shift to notched projectile point forms (Kirk and Palmer types). The most notable aspect of this change was the appearance of processing stations along floodplain margins (Gardner 1974:24). Gardner has interpreted the appearance of these processing stations with respect to changing environmental conditions that occurred during the early Holocene, specifically the replacement of the late Pleistocene regime by a mixed coniferous-deciduous forest. The mixed coniferous-deciduous forest would have supported a broader variety of exploitable plant and animal species, particularly along the margins of inland swamps and bogs, and these microenvironments were quite favorable for the hunter-gatherer populations of the Early Archaic.

Excavations at the Fifty Site (44WR50) have provided the basis for much of Gardner's interpretation of the Early Archaic settlement and subsistence patterns. This site was located adjacent to a backswamp area along the South Fork of the Shenandoah River, and it contained a sequence of stratified Early Archaic living floors and activity areas (Carr 1974). The backwater swamp adjacent to the site would have supported a diversity of edible wildlife species, including small mammals, waterfowl, and plant foods, and this habitat was believed to have been the primary attraction for the Early Archaic groups that inhabited the site. However, the Fifty Site did not contain well-preserved faunal or floral remains, and the interpretation of the site as a food processing station was based primarily on a lithic tool assemblage that contained large chopping and scraping tools. These tools (large utilized flakes and bifaces) were described as implements that would have been used for butchering migratory waterfowl and various mammalian species. Although no plant food remains or plant food processing tools were recovered, it was reported that the environmental conditions were favorable for exploitation of both plant and animal foods (Carr 1974).

Middle Archaic settlement models for the Middle Atlantic region are not well developed, and there is a lack of agreement among archaeologists regarding the bracket dates for that period. Gardner and many of his associates use a beginning date of circa 6500 BC for the Middle Archaic, arguing that the bifurcate-based points represent the initial phase of this period. Other investigators place the bifurcate-based points in the Early Archaic and use a more recent date of circa 6000 BC for the beginning of the Middle Archaic.

Regardless of whether or not the bifurcate-based points are considered Early Archaic or Middle Archaic, there is a paucity of data pertaining to the interval between 6000 BC and 4000 BC. Following Carbone's (1976) regional paleoclimatic reconstruction, most investigators believe that the onset of Atlantic climatic conditions occurred circa 6500 BC, leading to an expansion of wetland habitats, and there is much regional evidence that the Archaic hunter-gatherer groups that used bifurcate-based points expanded into the newly emergent wetland habitats (Gardner 1987; Steponaitis 1980; Wanser 1982). In the Patuxent River drainage, Steponaitis (1980) has noted an increase in the occurrence of numerous bifurcate phase components relative to the preceding corner-notched phase, with a continuity in the choice of site locations.

Wanser (1982) has examined collections from southern Maryland (Charles and St. Marys counties), which includes the Zekiah Swamp area, one of the most heavily used resource zones during Maryland's prehistory. The collections generally support Gardner's assertions that there was a steady population increase during this time, with an increasing focus on interior swamps. However, Wanser did identify some anomalous patterns in the frequencies of diagnostic points for the Middle Archaic (circa 6000 to 4000 BC).

In the Delmarva Coastal Plain, Custer (1984) has observed that the most significant adaptive change associated with the Middle Archaic is the change in site locations. In the Delmarva region, this settlement shift is seen as an increased emphasis on the emerging swamp and marsh habitats that emerged at the beginning of the Atlantic climatic episode. Custer notes that the settlement shift is perhaps most apparent in the Piedmont, Ridge and Valley, and Great Valley regions of the Middle Atlantic, where there is an increased use of upland sites. Custer defines three principal site types: macroband base camps, microband base camps, and procurement sites. Macroband base camps, the largest settlements, were located at the emerging swamp and marsh habitats, while the microband base camps were located on smaller tributary streams that provided access to lithic resources and game. Procurement sites were located in a variety of settings which were attractive to game or which provided specialized non-food resources (Custer 1984).

Stewart has summarized the Middle Archaic adaptations in the Great Valley of Maryland, which in that region are marked by the appearance of bifurcate-based points. Using survey and limited excavation data, he observed that while there is a general continuity with the earlier Kirk phase, the Middle Archaic is characterized by a settlement focus on interior ponds, marshes, and springheads and an increase in the use of metarhyolite for chipped-stone tools, including the systematic use of quarries and quarry-related workshops (Stewart 1989a, 1990).

Wall (1990) has characterized the Early and Middle Archaic cultures in the Maryland Plateau region and adjacent Valley and Ridge province of Western Maryland as having a generalized foraging adaptation, with exploitation of seasonally available plant and animal resources in a wide range of habitats. Palmer phase adaptations include the use of large river terraces and upland swamp margins that would have provided various plant foods and game species. Some of the plant foods available in the upland swamp environments were large cranberry, blackberry, chokeberry, and raisin, although there is as yet no direct archaeological evidence of the use of these species. Wall's data indicate that the Middle Archaic settlement patterns were characterized by the use of a more diverse range of habitats, but with a tool kit similar to that of the preceding Early Archaic period (Wall 1990).

For the Southeast Atlantic Slope, Anderson and Hanson (1988) have proposed a settlement model for the Early Archaic, based on excavated sites in Georgia and South Carolina. In that region, investigators define the Early Archaic period as the early postglacial interval prior to the onset of the Atlantic climatic episode, circa 10,000 BP to 8000 BP. During this period, the regional environment was characterized by a mixed oak-hickory hardwood forest. The overall settlement pattern is viewed as a combination of Binford's collector and forager strategies, with seasonal movements within river drainages that crosscut the Coastal Plain and Piedmont. Base camps supported by logistical forays were established in the Coastal Plain during the winter, while a series of foraging camps were occupied during the remainder of the year as the population moved throughout the Coastal Plain and Piedmont. A general foraging strategy was followed during the warmer months, when plant foods would have been widely available. Hunting of deer, the primary game species, was productive only during the fall and winter, when these animals were more aggregated. In the Coastal Plain, settlement loci were to some degree constrained by the availability of lithic resources, but in the Piedmont the widespread availability of lithic sources would not have constrained group movements (Anderson and Hanson 1988).

Much of the Northeast was glaciated during the Pleistocene, and the Early and Middle Archaic settlement models for this region are based primarily on survey data, although a few sites have been excavated. Until recently the Northeast was thought to have been depopulated during the early postglacial period; however, investigators have recently identified a number of Early and Middle Archaic manifestations in that region. Many of the excavated sites with Early and Middle Archaic components are in settings that would have provided access to anadromous fish runs during the spring, but the overall importance of fishing in the Early and Middle Archaic subsistence pattern is not yet clearly understood (Barber 1980; Bolian 1980; Dincauze 1976). Focusing on the Merrimack River Basin in New Hampshire, Nicholas (1983, 1987) has identified wetland areas that developed in the glacial lake basins as the most productive environmental zones during the early postglacial period (circa 10,000 to 7500 BP). Rather than a highly specialized or focused subsistence strategy, Nicholas has proposed a more diffused or generalized subsistence pattern, termed the Glacial Lake Basin Model. This model exhibits a generalized subsistence economy and a highly focused land-use pattern, characterized by reoccupation of sites along the swamp margin (Nicholas 1983, 1987).

In the Middle Atlantic Coastal Plain, the Late Archaic is generally viewed as a period of population increase, with evidence of increased sedentism and larger population aggregates. Steponaitis notes that in the Patuxent River drainage, Late Archaic sites are most frequently found along inland swamps and second- and third-order streams. In the Lower Potomac drainage, there is some evidence of a shift to areas that supported intensive mollusc exploitation (Gardner 1987), but a continued emphasis on the exploitation of inland swamps has also been noted (Wanser 1982). Custer has observed that a distinctive characteristic of the Late Archaic settlement system is the presence of base camps along major drainages that supported much larger population aggregates and a corresponding abandonment of sites in other locations. The intensification of settlement in the major riverine zones is possibly related to the warm, dry conditions associated with the Subboreal climatic episode, which possibly decreased the carrying capacity of marginal areas that were exploited during the Atlantic episode (Custer 1984). The availability of cobble sources has been noted as an important determinant in the settlement pattern of hunter-gatherer populations in the Middle Atlantic region (Custer et al. 1983), and the availability of a secondary lithic source appears to have been an important factor in the aboriginal use of the Indian Creek Site.

Ethnography can provide an important source of information regarding the settlement patterns of extinct hunter-gatherer cultures. Using analogy with groups that are documented in the ethnographic literature, it is possible to expand the range of testable hypotheses for archaeological interpretation thereby gaining a more complete understanding of the behavioral context (Ascher 1961; Binford 1967). Custer (1990) has argued that the spruce-dominated boreal forests of the Eastern Subarctic and the Labrador peninsula provide the best modern analog for the environmental conditions that characterized the Middle Atlantic region during the Early and Middle Archaic. Therefore the ethnographically documented hunter-gatherer groups in this region may be used to develop behavioral analogies for the Early and Middle Archaic populations in the Middle Atlantic. Various hunter-gatherer groups in the Eastern Subarctic are frequently considered together as the Montagnais-Naskapi, including the Montagnais, the Eastern Cree, the Naskapi and the Attikamek. Important features of these groups is their high degree of mobility, flexible social organization, and utilization of a broad range of microenvironments within the boreal forest. Their territorial range is quite broad, and their annual round spans distances of up to 300 miles (500 km). Their subsistence needs are met chiefly by hunting, but fishing and gathering provide an important dietary supplement (Custer 1990).

Fitzhugh (1972) has summarized the ethnographic literature pertaining to the Eastern Subarctic, focusing on the subsistence-settlement systems of the region's hunter-gatherer groups. The Montagnais-Naskapi and the Eskimo are the region's two distinct aboriginal cultures, and they are distinct groups that inhabit different ecological zones. The Montagnais and Naskapi inhabit the interior zone of the Labrador-Quebec peninsula, while the Eskimo inhabit the coastal areas of the Atlantic Ocean and Hudson Bay. The Montagnais-Naskapi, who speak a dialect of the Eastern Cree that is part of the Algonkian stock, represent the closest ethnographic analog for hunter-gatherer groups in the Middle Atlantic.

The Montagnais-Naskapi annual round is characterized by a high degree of seasonal variation, with many alternatives for each season. Bands average 50 to 100 individuals in size, and they usually consolidate once or twice a year, usually in the early spring or summer. Although there is much variation among bands and among extended families comprising a particular band, the general annual round is as follows. In the spring, bands typically coalesce at centrally located gathering sites at streamside or lakeside foci where feasting, marriage, and other social activities take place. During the remainder of the year, extended family groups disperse to hunt. In summer, groups typically move to the coast or inland lakes to fish and hunt waterfowl, while caribou hunting in the interior forests is the mainstay of subsistence activity during the winter. Winter is the most severe time, and very little food is available. However, the cold months are most favorable for hunting. Caribou form herds during this period, but their migratory patterns require nearly constant movement between campsites (Fitzhugh 1972). Figure 12 outlines a generalized annual cycle for the Montagnais-Naskapi.

Plant foods are most important to the Montagnais-Naskapi during spring and autumn. Plant foods, particularly berries, are most abundant during the spring, but fish, migratory birds and large mammals emerging from hibernation are also taken at this time of year. Berries are also important during late summer and autumn when extended family groups occupy fishing camps or hunting camps (Fitzhugh 1972).

3. Activity Area Reconstruction

The Phase II archaeological testing program suggested the presence of discrete activity areas within the site. This was manifested by the presence of well-preserved features as well as the spatial clustering of certain raw materials and tool types. Based on the Phase II analysis, areas within the site were identified that appeared to have been the foci for the following activities: (1) primary lithic reduction, i.e., initial core reduction using hammerstones; (2) lithic reduction of quartz implements using a soft-hammer reduction technique; (3) the final shaping or maintenance of chert, jasper, and rhyolite tools; and (4) the processing of plant foods for immediate consumption.

Area 3 has been interpreted as a periodically revisited gathering camp or procurement site at which a variety of extractive and maintenance tasks were carried out. These activities would have included food processing (butchering, plant food processing, cooking, etc.), consumption, discard of waste, tool manufacture, tool maintenance, small craft activities, storage of food and tools, sleeping, and conversation. Although one or more of these activities may be inferred on the basis of individual tools, features, or waste material, the arrangement of these activities within the site is

	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.
SETTLEMENT TYPE	Trapping Camp	Caribou Hunting Camp	Caribou Hunting Camp	Caribou Hunting Camp	Spring Gathering	Summer Fishing Camp	Summer Fishing Camp	Summer Fishing Camp	Summer Fishing Camp	Fall Hunt Camp	Fall Hunt Camp	Trapping Camp
SOCIAL UNIT	Family Group	Family Group	Family Group	Family Group	Band	Band	Family Group	Family Group	Family Group	Family Group	Indi-vidual Family Unit	Indi-vidual Family Unit
FISHING	Ice Hole Fishing and Spearing	Ice Hole Fishing and Spearing	Ice Hole Fishing and Spearing	Ice Hole Fishing and Spearing	Trout	Trout	Trout and Salmon	Trout and Salmon	Trout	Trout		Ice Hole Fishing and Spear-ing
HUNTING	Ptarmigan, Caribou, Small Game	Ptar-migan, Caribou, Small Game	Ptar-migan, Caribou, Small Game	Ptar-migan, Caribou, Small Game	Duck, Goose, Black Bear, Small Game	Duck, Goose, Black Bear, Seal, Small Game	Small Game	Black Bear, Small Game	Black Bear, Duck, Goose, Small Game	Caribou, Duck, Goose, Small Game	Caribou, Small Game	Ptar-migan, Small Game
TRAPPING	Trapping									Trapping	Trapping	Trapping
PLANT FOOD				Berries	Berries			Berries	Berries	Berries		

Source: Fitzhugh (1972:49).

FIGURE 12: Montagnais-Naskapi Subsistence/Settlement Pattern

the focus of activity area reconstruction. Activity area reconstruction may be treated as a subset of settlement patterns. As discussed in the preceding section, macrosettlement patterns refer to the regional distribution of sites, and the microsettlement patterns refer to the internal structure of individual sites (Trigger 1968).

Investigation of the site structure focuses not only on the identification and spatial delineation of activity areas, but also on site formation, which is a closely related issue. Given the lengthy period during which the site was utilized by hunter-gatherer groups, there is no doubt that many different activities were carried out within the same relatively restricted space. Notwithstanding the preservation of features in subsoil contexts, the mixing of material associated with different occupations of the site should be expected. Although the individual episodes of site occupation may have been quite restricted in scope, the succession of occupational episodes would produce a complex of overlapping patterns, a palimpsest that might be understood only by the use of multivariate analytical techniques (Binford and Binford 1966).

Based on ethnographic information from various hunter-gather societies and excavation data, Binford (1983) has identified a number of cross-cultural similarities in the way individuals and groups carry out tasks and discard debris in residential and nonresidential sites. Within a campsite, hearth areas are normally the foci around which a broad range of activities are carried out, and Binford (1983:149) suggests that hearths are not only focal points around which activities were organized but that these tasks were performed "according to a spatial pattern that appears to be universal." Site structure may be viewed as a conglomerate of individual modules that represent either distinct activities or social units. The representation of social structure in space is a culturally universal phenomenon, and occupation sites often contain a series of small areas of equivalent size and form that correspond to social units such as households or extended families.

The patterning of refuse deposits around hearths typically exhibits a concentric form. Small items, such as waste products from craft activities, are normally found between the hearth and the seating area, while larger items are discarded to a "toss zone" away from the primary seating and work area. There are a few basic patterns of refuse disposal among hunter-gatherers that account for the major patterns of archaeological site structure. These basic disposal modes include: (1) dropping or discarding objects in their place of use, (2) tossing individual items away from their place of use or consumption, and (3) dumping a group of items en masse. Small dumps often appear to have a "magnetic" effect, as they accumulate material from subsequent refuse disposal episodes (Binford 1983).

Distinct disposal patterns may be observed inside and outside of structures. While the concentric, or donut-shape, pattern is typically left by groups around an outside hearth, greater effort is normally made to maintain the cleanliness of indoor domestic spaces. Refuse dumps are typically located immediately outside the door, left there after cleaning a domestic space. Activities that produce large amounts of waste material are typically located away from the primary living area, so that debris may be left in place, away from the primary living area. Sites that are intended for re-use, including the peripheral areas adjacent to the primary habitation areas, are typically cleaned of debris (Binford 1983).

4. Technology

The technology theme identified in the State Plan may be addressed both by investigation of the fire-cracked rock features and by analysis of the lithic technology represented at the site.

The two fire-cracked rock (FCR) features identified during the Phase II testing program were interpreted as cooking areas, presumably related to the processing or cooking of plant foods. During the Phase III excavations, many more of these FCR features were identified, and they constitute the principal class of features at the site.

The use of rock in aboriginal cooking is well established in the ethnographic literature of North America, and there are a variety of cooking methods that involve the use of rock. These include roasting over dry heat, container boiling, and steaming (H. Stewart 1982). None of these required the use of pottery, so that all could have been used by Archaic populations. Throughout the Eastern Woodlands, Archaic groups brought rocks to occupation sites for use in cooking, and a variety of cooking methods may be inferred from excavated archaeological features.

The site's lithic assemblage provides direct information regarding the technologies used in the production of stone tools, and functional analysis of the stone tools themselves provides information regarding the types of activities that were carried out at the site. Some of the raw materials used at the Indian Creek Site were derived from nonlocal sources, but there is also extensive evidence of the use of secondary cobble deposits available at the site. Area 3 partially overlies a relic gravel bar which provided a source of lithic raw material. Spatial analysis conducted during the testing program (LeeDecker et al. 1988) indicated a pattern of initial reduction at the raw material source, with final shaping and finishing apparently postponed until the time of use. Within Area 3, different stages of the overall lithic reduction sequence appear to have been carried out in spatially distinct areas.

Based on studies of aboriginal quarry sites within the District of Columbia, Holmes (1897:53-54), working in the late nineteenth century, developed some of the original archaeological models for bifacial tool production, and general principles of lithic technology. Experimental and ethnoarchaeological studies conducted by Callahan (1979), Clark (1986), Crabtree (1972), Flenniken (1981), and Gould (1980) have provided a means for direct interpretation of the Indian Creek Site assemblage.

5. Environmental Adaptation

The environmental adaptation theme examines cultural response to changing environmental conditions. Significant environmental changes occurred during the period of aboriginal site occupation, and it is assumed that cultural responses to these changes would be reflected in the composition of tool kits and in the subsistence patterns. Subsistence and settlement pattern issues, discussed above, pertain directly to the environmental adaptation theme.

Reconstruction of past environmental conditions provides the necessary context for examination of this theme, and Carbone (1976) and Custer (1984) have provided important baseline information for the region. Detailed information for the prehistoric conditions in the immediate site vicinity was obtained from a geomorphological investigation of the Indian Creek floodplain and from analysis of a locally obtained pollen core.

C. METHODOLOGY

1. Sampling Strategy and Field Methods

A total of 124 units were excavated during the data recovery program at Area 3. The Phase II excavation sample included 20 5x5-foot squares, and the Phase I sample included 5 3x3-foot units and a number of shovel tests. Altogether, the excavated sample from Area 3 encompasses an area of approximately 3,600 square feet.

The Phase III excavation strategy was based on a sampling plan that included three principal components: (1) scattered, exploratory units within previously untested areas of the site, (2) block areas centered on features identified during the Phase II testing program, and (3) block areas centered around newly identified features. On the basis of the Phase II testing, six areas were identified for block excavations. These include the two FCR features (Features 2 and 3) and the

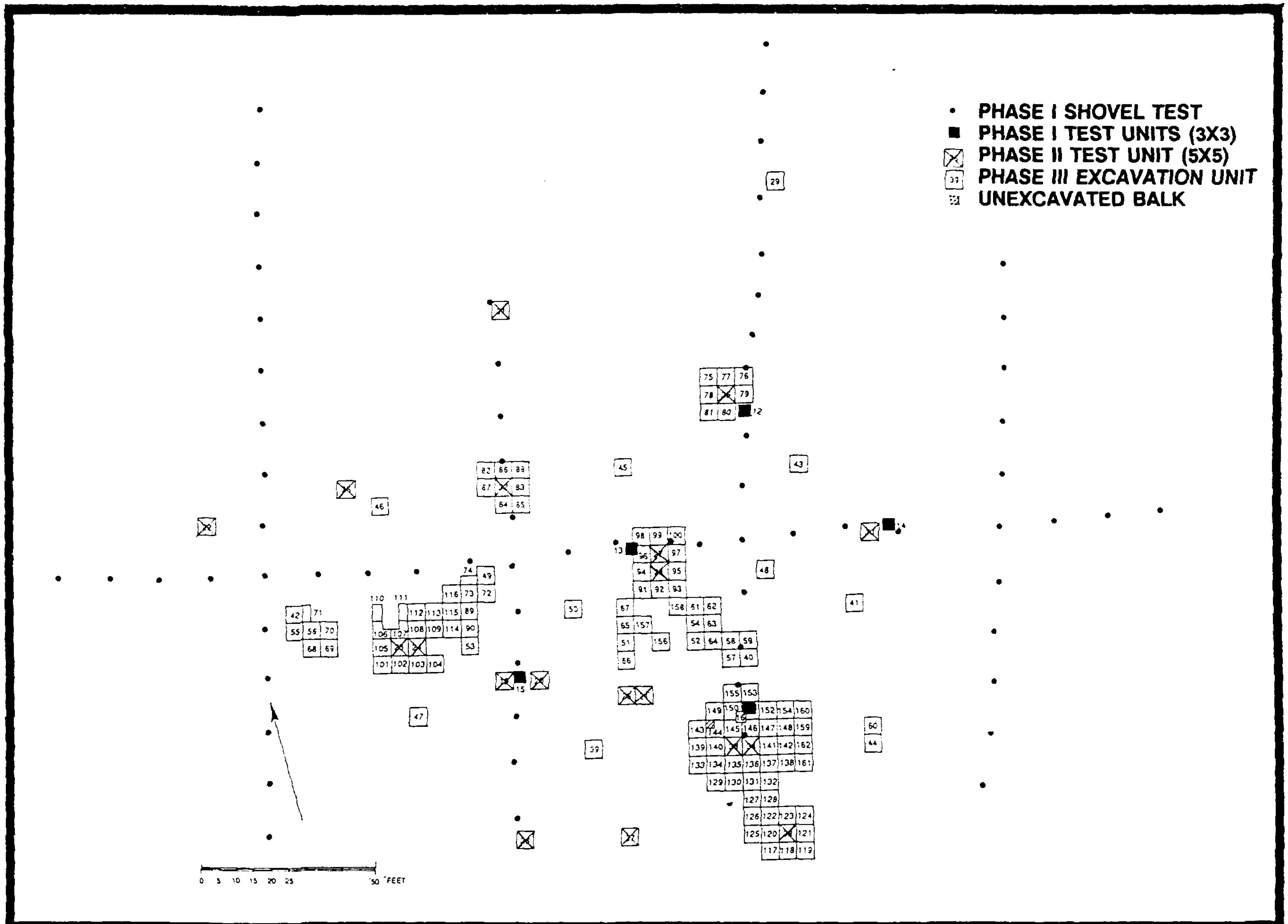


FIGURE 13: Excavation Sample, Phases I, II and III

two lithic workshop features (Features 4 and 5). Also, an excavation block was placed around Units 27 and 28, where a large quantity of FCR suggested the possible presence of an additional FCR feature, and an excavation block was placed around Unit 38, where two Early Archaic points were recovered. Figure 13 portrays the distribution of the Phase I and Phase II excavation units.

The exploratory units were scattered throughout the site to provide a spatially more representative sample, emphasizing the core area of the site as defined during the preceding investigations. The Phase II program provided sufficient information to define the general distribution of features and artifact concentrations within the site, and this information was used to guide the placement of the exploratory units. The sampling plan included a number of reserve units that were used to enlarge block excavations around significant features or deposits that were identified as the data recovery program proceeded.

The field methods used during the data recovery program were virtually identical to those of the Phase II program, to permit integration of the results of both phases of work. During the testing program, a vertical datum and a horizontal grid system were established for the site, and these were relocated and used as the primary spatial control systems. As in the Phase II program, the primary excavation units were 5x5-foot squares. The plowzone stratum was removed as a single level, then the underlying subsoil levels were removed according to 0.3-foot levels. Subsoil levels were excavated by quadrants (2.5x2.5-foot squares), in order to permit finer-grained spatial analyses. Excavated soils were sifted through 1/4-inch screen. When possible, tools in subsoil levels were point-plotted and assigned artifact numbers to enable reconstruction of activity areas. Features and soil profiles were drawn to scale and photographed using black-and-white and color slide film. In some situations, overhead photography was used to record occupation floors.

Excavated soils were described according to standard USDA soil textural classes and Munsell soil color notation. During excavation, soil samples were removed for flotation processing, soil chemistry analysis, and pollen analysis. Flotation samples were taken from feature contexts and from subsoil levels of other units distributed across the site for subsequent processing and analysis. The standard procedure for the taking of flotation samples was to remove a two-liter soil sample from the northeast corner of a selected unit, to provide a more or less continuous column sample. Off-site soil samples were also obtained for use as control samples. Soil samples intended for chemical analysis were taken primarily from feature contexts, but these also included non-feature contexts and off-site contexts. Small soil samples (25-30 ml) were also retained for pollen analysis; these were obtained from feature contexts and from the dried flotation samples. After processing, cultural material was picked from the flotation samples and cataloged with the remainder of the artifact collection.

Historic material was recovered during the Phase II excavations but it was determined to be representative of dumping activity rather than residential refuse. During the Phase III fieldwork, historic material was noted and discarded in the field, except for a few particularly diagnostic items, including whole vessels and marked sherds.

2. <u>Artifact Processing and Analytical Methods</u>

A substantial artifact sample had been recovered from the site during the Phase I and Phase II investigations. In order to take full advantage of the existing information, the analytical procedures for the Phase III material were designed for compatibility with the existing database.

The artifact collections were processed for eventual storage and curation by the Maryland Historical Trust's Office of Archeology. Artifacts were assigned catalog numbers according to the system developed by the Division of Archeology, Maryland Geological Survey, which has been incorporated into the Maryland Historical Trust. In this system, a number is assigned to each provenience within the site, beginning with the number "1." The Webb collection had already been assigned the first catalog number, so the collections recovered by LBA were assigned catalog numbers beginning with the the number "2." Blocks of catalog numbers were assigned according to the following scheme:

Catalog Numbers	Portion of Collection
1	Webb Collection
2-200	Surface Collection
201-499	Shovel Tests
501-599	Phase 1 Test Units
601-999	Phase 2 Test Units, Area 3
1000-3133	Phase 3 Excavation Units, Area 3
9991-9995	Off-Site Soil and Flotation Samples
9999	General Site Provenience, Area 3

The prehistoric material, which by far comprises the majority of the collection, was composed entirely of lithic items and, with the exception of artifacts tested for blood residue analysis, these were cleaned by immersion in plain water and scrubbing with a soft brush.

Tools and diagnostic artifacts were marked with the site number and catalog number. After the collections were sorted according to major classes (bifaces, cores, flakes, fire-cracked rock, etc.), they were placed in resealable plastic bags with a card containing the following information: (1) site number, (2) unit identification, (3) level, (4) stratum, (5) date of excavation, (6) excavator's initials, and (7) catalog number. Artifact numbers and three-dimensional coordinates were also provided for items mapped in situ.

Artifact cataloging and tabulation were accomplished by a computerized database system developed by the LBA Cultural Resource Group. The database was developed using the MicroRim Inc. RBase System V™ relational database software package, which runs on IBM PC XT™ and compatible microcomputers. The overall database for this project contains five principal files: (i) provenience, (ii) prehistoric tools, (iii) prehistoric debitage, (iv) floral material, and (v) historic artifacts. During the Phase III analysis, the existing database architecture was modified to allow more efficient use of disc storage and computer memory. These modifications included archiving the historic artifact files and separating of the prehistoric database into two files: tools and debitage (fire-cracked rock and unmodified flakes). The analytical procedures used for the lithic and botanical analysis are discussed separately in Chapters VII and IX. Appendix E contains a discussion of the computer cataloging and database design.

V. SOILS, STRATIGRAPHY, AND SITE FORMATION PROCESSES

Four principal strata (A, B, C, and D) were defined during excavation. These stratigraphic designations provided a consistent field terminology for use during testing and data recovery, but they do not correspond to precisely defined pedological units. The stratigraphic profile of Test Unit 33 (Figure 14) portrays the typical stratigraphy for the central area of the site. First, a clearly defined plowzone was recognized by the presence of plowscars that were consistently oriented in a northwest-southeast direction. The plowzone, designated as Stratum A, generally extended to one foot or less below the surface. Strata B and C were yellowish brown sandy loams, distinguished by a slightly paler color and a higher silt and clay content in Stratum C. Stratum D, the argillic horizon, was distinguished by its more compact texture and by the presence of reddish brown clay and iron-enriched pockets.

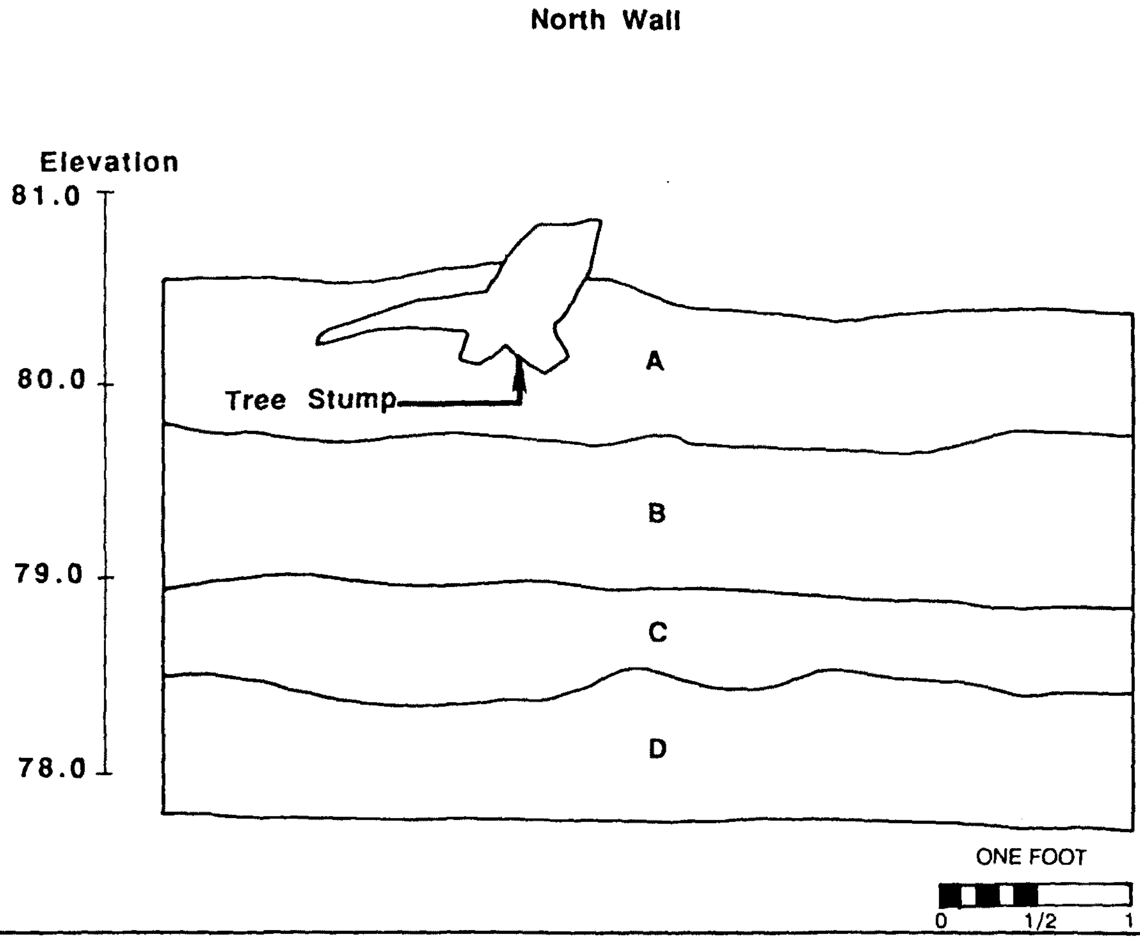
Gravel and cobble inclusions were most concentrated within the north-central area of Area 3, indicating the presence of a relic gravel bar. Units in this area exhibited gravels and cobbles through the full depth of excavation, usually increasing with depth. The stratigraphic profile of Unit 29 (Figure 15) is generally typical of the soils in the north-central area of the site.

The Area 3 locus is occupied by very sandy, moderately well-drained terrace soils containing marbled argillic subsoil horizons. Subsoil development is weak, and even the clay-enriched argillic horizon textures are rarely finer than loamy sand. The upper soil horizons are also loamy sand, and the texture of the parent material beneath the soil is also sand, but increasing clay contents with depth clearly demonstrate the presence of argillic horizons. Although the soil profiles throughout the site were quite similar, especially in the upper, cultural levels, some degree of variability within the site is demonstrated by the clay content in the argillic horizons. For example, the argillic horizon clay contents are nearly twice as great in the profile of Unit 40 as in that of Unit 49. Increases in subsoil clay contents are relatively slight in both profiles, suggesting both weakly developed and hence relatively young argillic horizons. However, argillic horizon expression, although heavily age dependent, may be weak even in very old sandy soils (Wagner 1990).

The broken, marbled nature of the argillic horizons is significant in assessing the potential age of the site soils and landscape. The argillic horizons do not occur as homogeneous layers, but rather as disrupted bodies mixed with bodies having few or no characteristics normally associated with argillic horizons. In terms of soil genesis, it is not clear why the argillic horizons occur in disrupted forms. The argillic bodies may have originally formed this way as a result of weathering mechanisms limited by the wet, sandy conditions of the site, or they may have undergone partial destruction since forming. Whatever the cause of the disruption, however, the argillic horizons are strongly developed, implying that the site landscape has remained stable probably since the late Pleistocene (Wagner 1990).

Although old subsoil horizons are indicative of essentially stable landscape conditions throughout the Holocene, the uppermost soil layers clearly have been susceptible to some modifications. This is apparent in the shallow burial of cultural features, and might be expected in any occurrence of very sandy soils. Due to a higher incidence of tree fall as well as insect and animal burrowing in sandy soils, surface horizons undergo more frequent mixing than occurs in finer-textured soils. Local aeolian activity as well as occasional flooding could also account for minor modifications to the site surface (Wagner 1990).

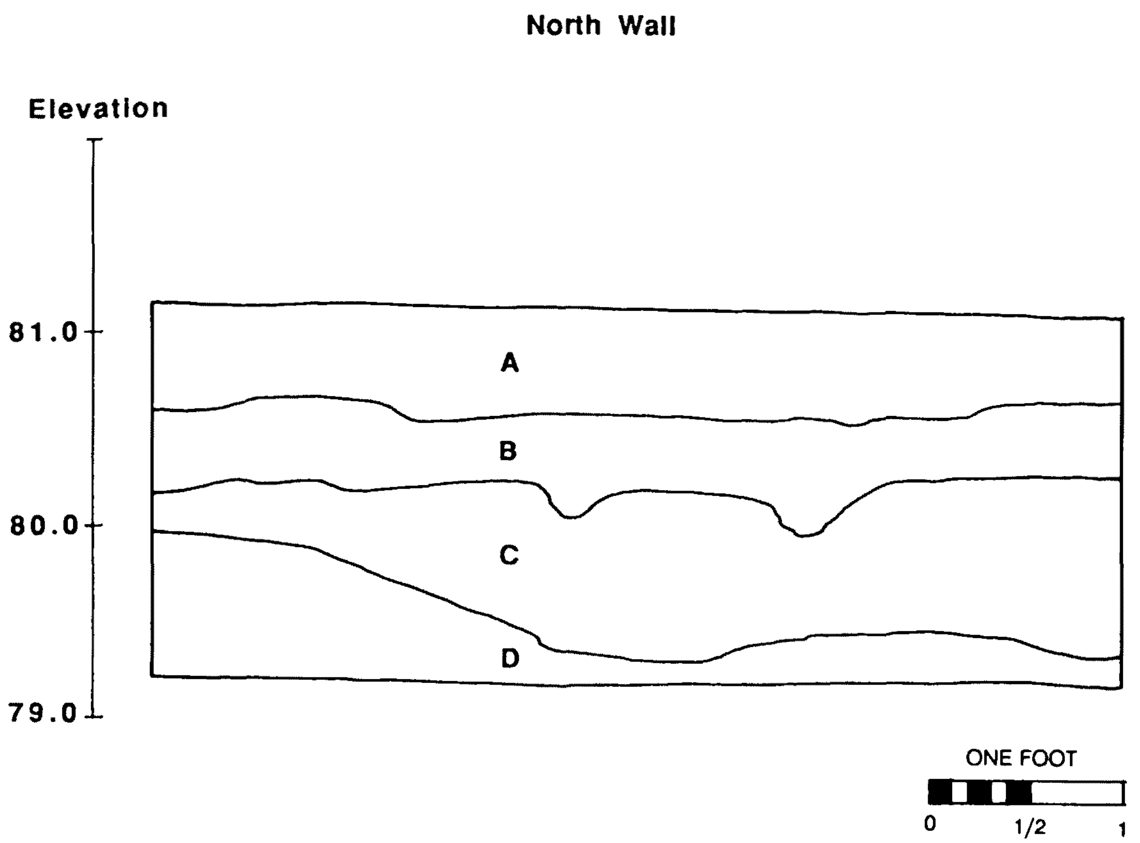
Prehistoric artifacts were recovered from the plowzone to a maximum depth of 3.8 feet below the extant ground surface. Distributional plots of cultural material (Figure 16) indicate that 29 percent of the material was recovered from the plowzone (designated Horizon 1 or Level 1 in the field).



LEGEND

A Plowzone; dark yellowish brown (10YR4/4) sandy loam.
B Yellowish brown (10YR 5/6) loamy sand.
C Yellowish brown (10YR 6/6) loamy sand.
D Mottled strong brown (7.5YR 5/8) and light yellowish brown (10YR 6/4) loamy sand with cemented iron nodules and manganese nodules, increasing at base.

FIGURE 14: Stratigraphic Profile, Test Unit 33



LEGEND

A Plowzone; dark brown (10YR3/3) gravelly loamy sand.
B Plowzone; compact dark brown (10YR 3/3) gravelly loamy sand.
C Yellowish brown (10YR 5/6) gravelly loamy sand.
D Gravels in very pale brown (10YR 7/4) loamy sand with iron concretions.

FIGURE 15: Stratigraphic Profile, Test Unit 29

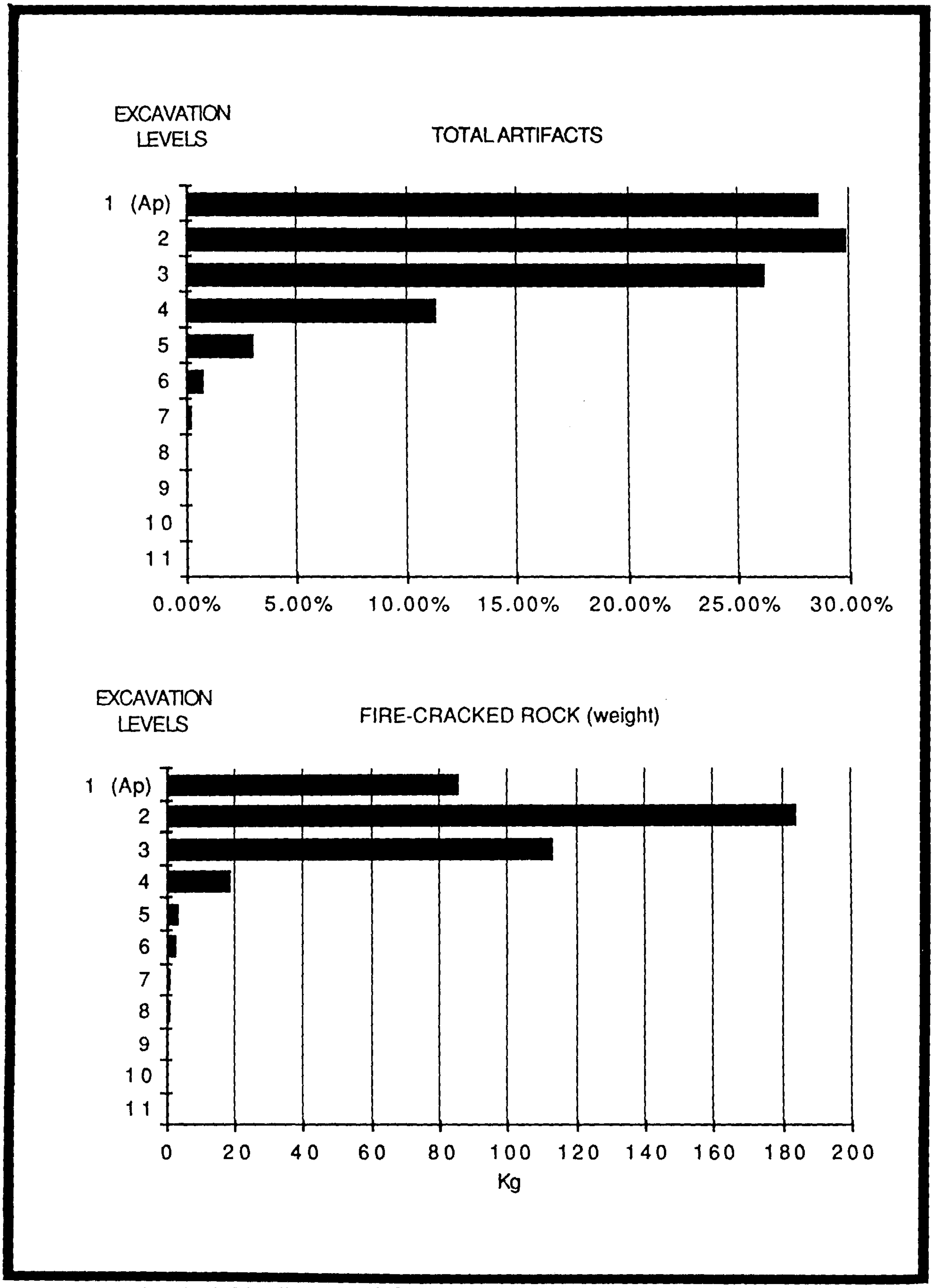


FIGURE 16: Vertical Distribution of Cultural Material

Level 2 contained the greatest concentration of material, 30 percent of the total Area 3 assemblage, followed by successively decreasing amounts in the underlying subsoil levels. Levels more than 3 feet below the surface contained only 0.1 percent of the total assemblage. The burial of prehistoric features and deposits within Area 3 must be attributed to some mechanism, either natural or cultural, and it is necessary to examine the distributional patterning of features, diagnostic artifacts, and artifact crossmends in order to assess site formation processes.

The features identified within Area 3 originated at depths ranging from 0.87 to 2.31 feet below the surface, as shown in Figure 17. The most deeply buried feature, Feature 6, may be the remains of a roasting pit; therefore its depth of origin cannot be interpreted as an occupational surface. The remainder of the features represent fire-cracked rock clusters or lithic workshop areas, and these are assumed to have been deposited on actual occupation surfaces. When Feature 6 is excluded, the range of feature origins is considerably narrower, with a maximum depth of 1.79 feet; two-thirds of the features originated between 0.87 and 1.4 feet below the extant surface. The burial of features indicates that roughly 2 feet of material have accumulated on the Area 3 ground surface since the site's initial occupation, roughly 10,000 years BP The recovery of material from levels below 2 feet may be attributed to natural pedoturbation processes such as animal burrowing and root activity.

Prehistoric occupation of Area 3 spans the rather lengthy period from circa 8000 BC to 1000 BC, but cultural stratigraphy was not apparent during excavation. However, analysis of the vertical distribution of diagnostic projectile points in the assemblage indicates that although some vertical mixing has occurred, there is some temporal stratification in the deposits. Two broad temporal categories, Early Archaic and Late Archaic, were defined for this analysis, and the frequencies were plotted according to vertical provenience (Figure 18). Both groups overlap to a considerable extent, but each group has a distinct distribution. The Late Archaic group is most abundant in the plowzone and first subsoil level (Levels 1 and 2), and the Early Archaic group is most abundant in the second subsoil level (Level 3), followed by the first subsoil level (Horizon 2). Rank-order statistical tests that were applied showed a negative correlation between the two point groups, which indicates that the deposits are temporally ordered or stratified. However, none of the coefficients were statistically significant. There are problems with the application of statistics that use ordinal measures (Blalock 1972:426), and in this case visual representation of the data (see Figure 18) illustrates the depositional situation most clearly.

For the most part, the archaeological features and deposits are representative of material deposited on an occupation surface, and their burial is attributable to natural processes. Pedological analysis did not indicate any lithological discontinuities, suggesting that artifact burial was primarily accomplished either through very localized reworking of the site soils or through the introduction of new materials comparable to those already on the site. The scarcity of recent alluvium in the abandoned channel near Area 3 suggests that flooding was infrequent; however, the preservation of intact features would be inconsistent with burial by reworking of the local soils. Accretion of the landscape surface is most readily attributed to the introduction of new material, most likely as a result of alluvial deposition, but possibly supplemented by aeolian activity. The homogeneous texture of the surficial soils would be consistent with accretion by introduction of new material, but only if introduced at rates sufficiently gradual to disguise different materials through the blending action of pedoturbation processes (Wagner 1990). The accumulation of 2 feet of soil over a period of 10,000 years, an average rate of less than 1 centimeter per 150 years, should be considered gradual.

The absence of lithological discontinuities in the stratigraphic profiles would be most consistent with a gradual, rather than episodic, introduction of new material. Moreover, a factor that would have accelerated the integration of new material into the existing soils is the sandy texture of the local soil. Experimental studies have demonstrated that sandy soils are much more readily "homogenized" than more finely textured soils (silts and clays) as a result of common processes

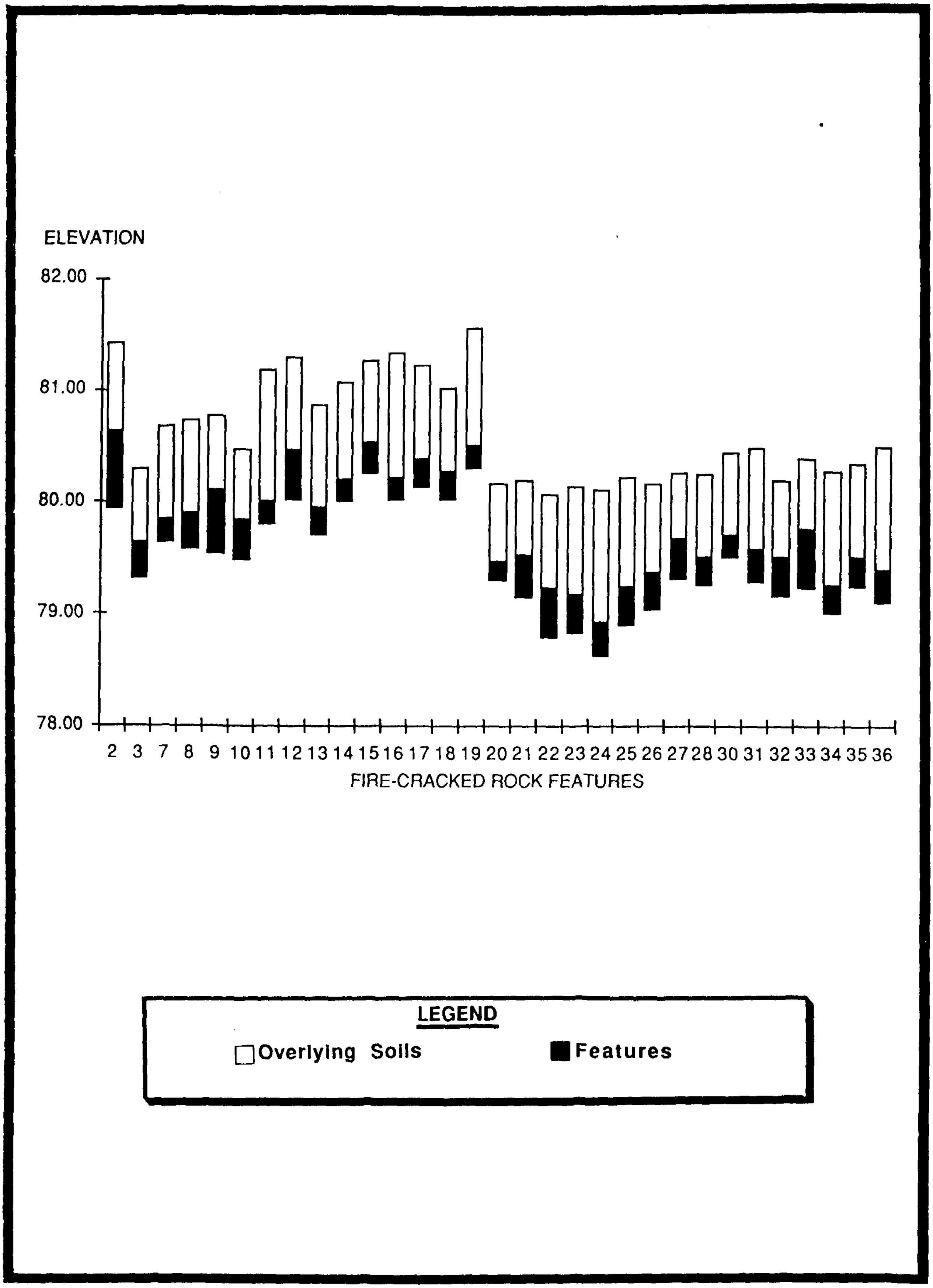


FIGURE 17: Vertical Origin of Features

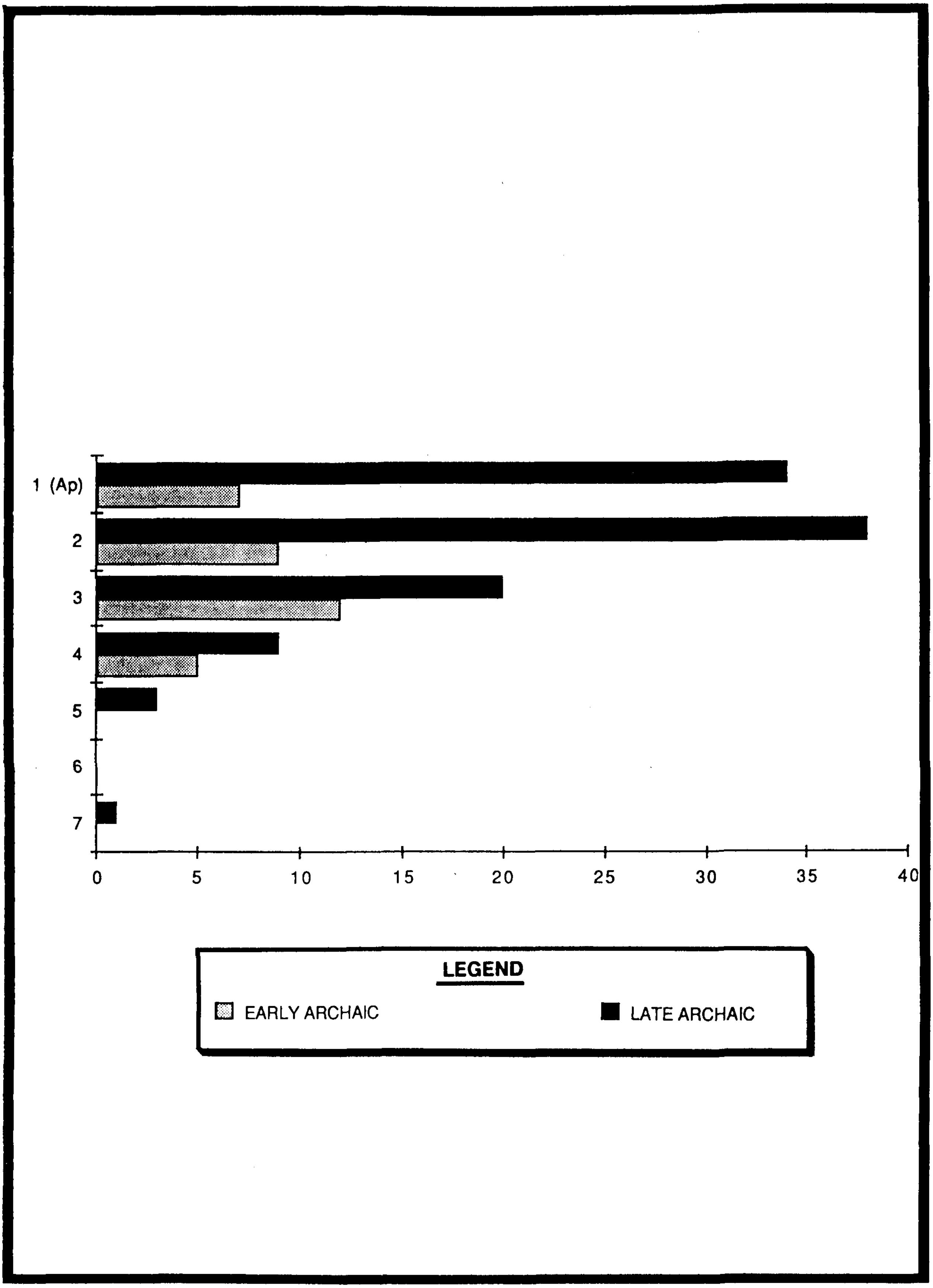


FIGURE 18: Vertical Distribution of Diagnostic Projectile Points

such as animal burrowing, trampling, root growth, tree fall, freeze-thaw, etc. (Wood and Johnson 1978). Some downward movement of artifacts within the soil profile would be attributable to these pedoturbation processes, and this would account for the infrequent recovery of cultural material in the lowermost levels.

Crossmending, or refitting, of artifacts provides additional information pertinent to the understanding of the site's formation processes. Although there was no concentrated, systematic effort to refit artifacts during analysis, a number of crossmends were completed (Table 5). The vertical patterning, as opposed to horizontal patterning, of crossmends is most indicative of site formation processes. The majority of the mends involved the refitting of items within the same or adjacent levels, but one mend (No. 1) occurred across three excavation levels (i.e., Level 2 to Level 5), a vertical distance of roughly one foot.

The horizontal distances between crossmending artifacts may reflect segregation of activity areas, discard behavior, or post-depositional activities such as cleaning of the living area or historic plowing. Horizontally, the majority of crossmends occurred within the same unit or between adjacent or closely separated units, covering distances of up to 15 feet. However two mends occurred across distances of roughly 45 and 110 feet. Mend No. 10, which involved a piece of debitage and a biface fragment, occurred between units 45 feet apart. Both items were recovered from plowzone contexts, which may account for their wide separation. Mend No. 6 involved two fragments of a middle-stage biface, separated by a distance of more than 110 feet; the distance spanned by this crossmend would most likely be the result of discard behavior patterns rather than post-depositional disturbances, as both items were recovered from undisturbed subsoil contexts.

TABLE 5. SUMMARY OF ARTIFACT CROSSMENDS.

MEND NO.	CAT. NO.	UNIT	STRAT.	LEVEL	QUAD	REMARKS
1	1035	EU 40	C	5	NW	Two fragments of an indeterminate biface; units separated by 10-15 feet
	2628	EU 155	B	2	NE	
2	1221	EU 51	B	4	NE	Flake refitted to core in same provenience
3	1274	EU 53	A	1	.	Flake refitted to core; mend occurs within same unit
	1282	EU 53	B	3	SW	
4	1329	EU 55	A	1	.	Tip and midsection of an untyped projectile point; mend occurs between adjacent units
	1349	EU 56	B	3	NE	
5	1460	EU 62	B	2	SE	Two fragments of a middle-stage biface; mend within same unit and adjacent levels
	1462	EU 62	B	3	NE	
6	1405	EU 59	B	2	NW	Two fragments of a middle-stage biface; horizontal distance of approximately 110 feet
	1503	EU 63	B	3	NE	
7	1717	EU 80	B	5	NE	Tip and midsection of an indeterminate biface; mend occurs between adjacent units
	1828	EU 78	B	3	SE	
8	2070	EU 98	A	1	.	Haft element refitted to blade of projectile point; mend occurs between adjacent units
	2152	EU 96	B	2	SW	
9	2548	EU 133	B	2	NW	Flake refitted to core in same provenience
10	2200	EU 118	A	1	.	Chunk refitted to biface fragment; mend between plowzones of units separated by approximately 45 feet
	2884	EU 150	A	1	.	
11	2581	EU 147	A	1	.	Chunk refitted to biface fragment; mend between units separated by distance of roughly 15 feet
	2902	EU 160	B	2	NE	
12	2668	EU 140	B	3	NW	Three-way crossmend to form complete middle-stage biface; mend between adjacent units
	3068	EU 139	B	3	SW	
	3079	EU 139	B	5	NW	

Note: Stratum A, Level 1, refers to plowzone (Ap); Strata B and C include subsoil levels.

VI. ARCHAEOLOGICAL FEATURES

Thirty-five features were identified in Area 3, including 31 fire-cracked rock (FCR) concentrations, two lithic workshop areas, a charcoal concentration, and a cache of unfinished quartzite bifaces. Table 6 includes a summary of the features, and Appendix D provides a detailed description and summary of each feature's contents.

The 31 FCR features are not only the most numerous but also the most interesting features at the site. The intense reddening and irregular breakages on the surfaces of the rock indicate that the rocks were heated, but none of the FCR features was associated with charcoal or soil discoloration that would indicate burning in situ; therefore, they cannot be interpreted unambiguously as hearths. The one feature that did contain macroscopic charcoal (Feature 6) was not associated with fire-cracked rock. The fire-cracked rock features are illustrated in Figures 19-22, and Plate 1 illustrates Feature 2, which is a typical fire-cracked rock feature.

The use of rock in aboriginal cooking is well established in the ethnographic literature, and there are a number of different cooking methods that should be considered. These include roasting over dry heat, container boiling, and steaming (H. Stewart 1982). None of these required the use of pottery, so that all could have been used by Archaic and Paleoindian populations. Throughout the Eastern Woodlands, Archaic groups brought rocks to occupation sites for use in cooking, and a variety of cooking methods may be inferred from excavated archaeological features. For example, at the Longworth-Gick Site in Jefferson County, Kentucky, the Early Archaic (corner-notched points and bifurcate-based point) features included charcoal concentrations, rock-free areas of reddened soil, areas of reddened soil with charcoal, and small fire pits (Collins et al. 1979).

Experimental studies of fire-cracked rock feature replication were conducted in association with excavations at the Abbott Farm Site (Cavallo 1987; Cavallo and Kondrup 1986). These studies simulated container boiling and steam cooking, and the results showed distinctive patterns of cracking and breakage for each method. The Abbott Farm experiments also examined disposal patterns resulting from dumping the containers after boiling was completed. The typical container dump pattern was a circular to oval cluster with little peripheral scatter, a pattern that resembles many of the fire-cracked rock features at the Indian Creek Site, although the Indian Creek Site features are typically smaller and show a more dispersed rather than tightly clustered pattern. In the case of the Indian Creek Site features, dispersal may reflect post-depositional movement, a process that could not be replicated in the Abbott Farm experiments.

Analysis of the intrasite patterning indicates that the FCR features appear to be the foci of activities such as the rehafting of bifaces and lithic tool production. Binford (1983a) has presented ethnographic and excavation data indicating that hearth areas are normally the foci around which a broad range of activities are carried out in campsites. Given their morphology and spatial patterning within the site, the most straightforward interpretation of the FCR features is that they are cooking areas. However, it is not certain whether they represent roasting hearths, steam pits, or container boiler dumps. The lack of reddened soil, charcoal, and pit outlines provides the most compelling evidence for asserting that the features are container boiler dumps as opposed to roasting pits or roasting hearths, but a convincing interpretation must be based on more than negative evidence.

The 31 FCR clusters typically ranged from 1 to 2 feet in diameter, and they occurred in varying degrees of concentration. Some were dense, tightly packed clusters, while others exhibited a more scattered or diffuse appearance. The FCR features exhibited a mean horizontal dimension between 1.6 and 1.7 feet, with a range from 0.8 to 4.5 feet. Depths of the FCR features ranged from 0.17 to 0.69 foot, with an average vertical dimension of 0.32 foot. Nearly all features were exposed in

TABLE 6. SUMMARY OF FEATURES.

FEATURE NO.	UNIT	FEATURE TYPE	SIZE (N-S x E-W x D)
2	23-24	FCR Cluster	1.4' x 2.3' x 0.69'
3	33-34	FCR Cluster	3.0' x 2.5' x 0.32'
4	32	Lithic Workshop	4.0' x 5.0' x 0.55'
5	35	Lithic Workshop	2.5' x 4.8' x 0.74'
6	44	Circular stain with charcoal	1.7' x 1.4' x 0.78'
7	52	FCR Cluster	1.0' x 1.4' x 0.21'
8	54	FCR Cluster	2.5' x 2.0' x 0.32'
9	62	FCR Cluster	1.7' x 2.0' x 0.58'
10	58	FCR Cluster	1.9' x 2.6' x 0.36'
11	65	FCR Cluster	0.8' x 1.0' x 0.20'
12	73	FCR Cluster	1.0' x 1.0' x 0.45'
13	66	FCR Cluster	1.5' x 1.3' x 0.25'
14	67	FCR Cluster	1.4' x 1.5' x 0.20'
15	77	FCR Cluster	2.4' x 1.8' x 0.27'
16	78	FCR Scatter	3.8' x 4.5' x 0.20'
17	89-90	FCR Cluster	1.5' x 1.6' x 0.25'
18	98	FCR Cluster	1.6' x 1.9' x 0.25'
19	115	FCR Cluster	2.0' x 2.0' x 0.20'
20	122	FCR Cluster	1.0' x 1.0' x 0.17'
21	122	FCR Cluster	1.0' x 1.9' x 0.37'
22	120	FCR Cluster	1.0' x 1.2' x 0.31'
23	124	FCR Cluster	1.3' x 1.4' x 0.35'
24	120	FCR Cluster	1.0' x 1.1' x 0.44'
25	128	FCR Cluster	1.2' x 0.7' x 0.35'
26	128	FCR Cluster	0.9' x 1.3' x 0.33'
27	145-146	FCR Cluster	1.4' x 1.7' x 0.35'
28	141-142	FCR Cluster	1.7' x 1.8' x 0.25'
29	144	Cache of 6 quartzite bifaces	0.7' x 0.4' x 0.29'
30	151-153	FCR Cluster	1.1' x 1.0' x 0.20'
31	143	FCR Cluster	0.8' x 0.9' x 0.30'
32	137	FCR Cluster	1.9' x 1.8' x 0.35'
33	136	FCR Cluster	2.0' x 1.6' x 0.52'
34	136-137	FCR Cluster	1.9' x 2.7' x 0.25'
35	136	FCR Cluster	1.8' x 2.1' x 0.25'
36	129	FCR Cluster	1.5' x 0.9' x 0.29'

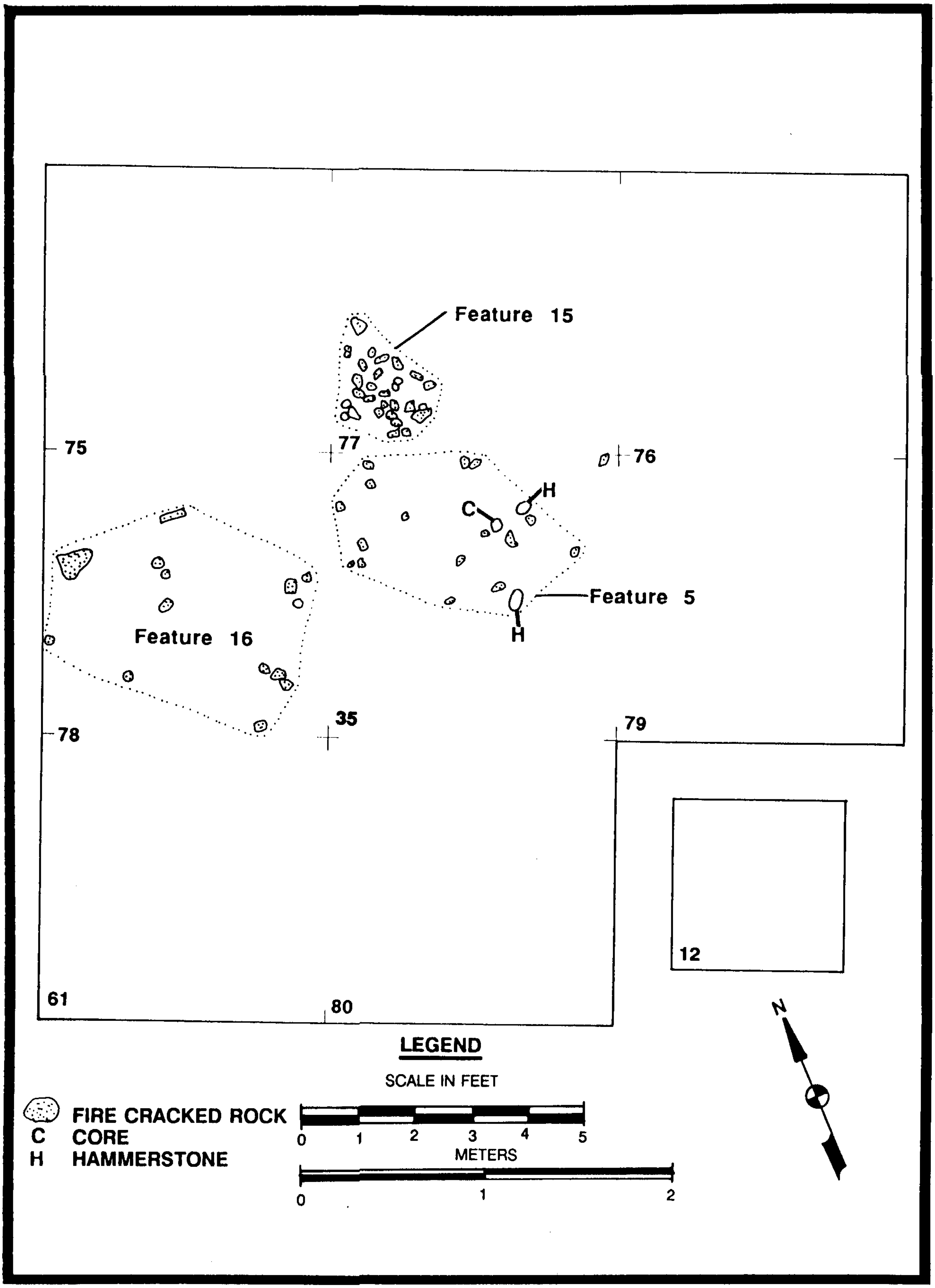


FIGURE 19: Plan View of Features, Excavation Block 1

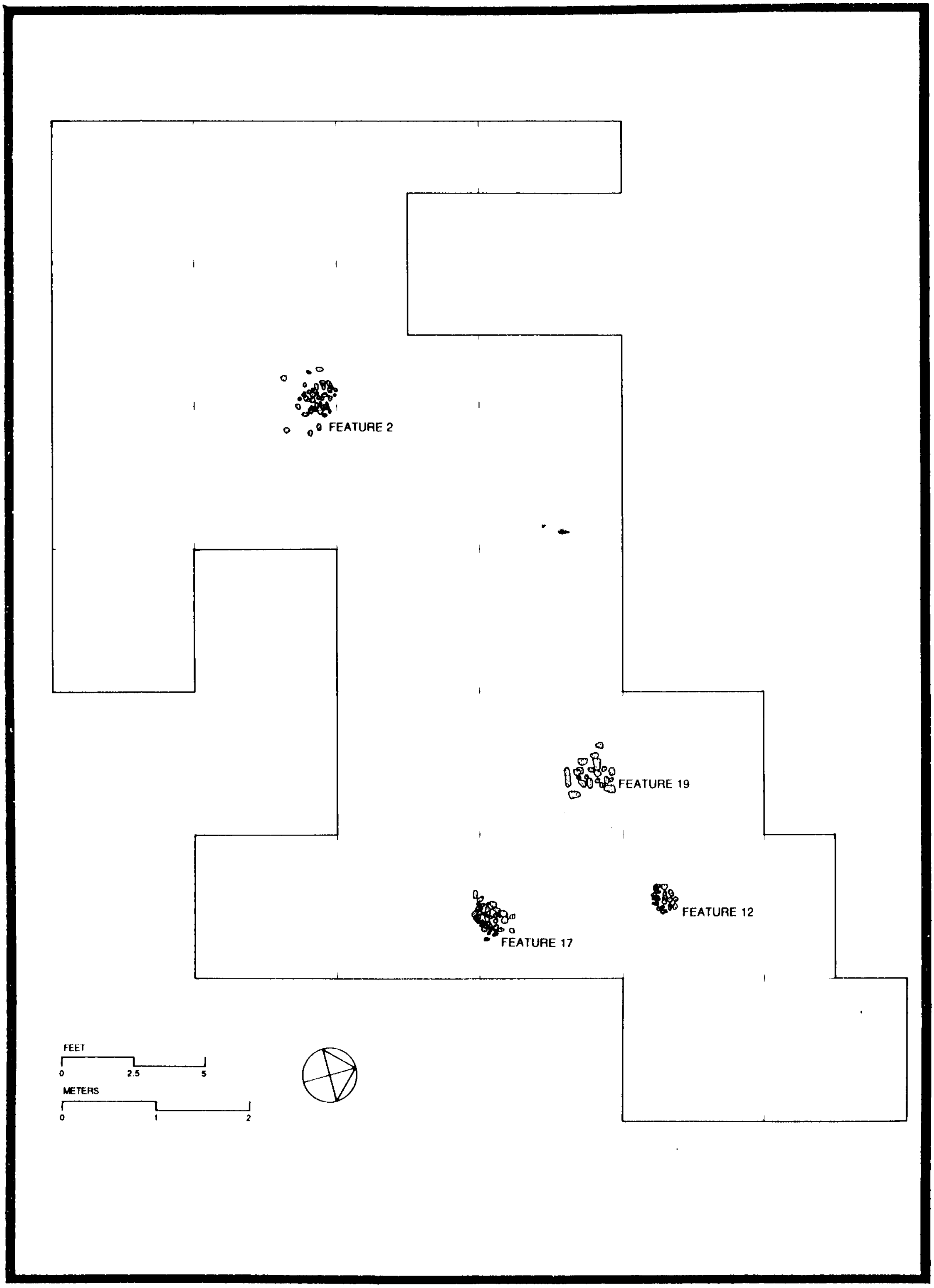


FIGURE 20: Plan View of Features, Excavation Block 4

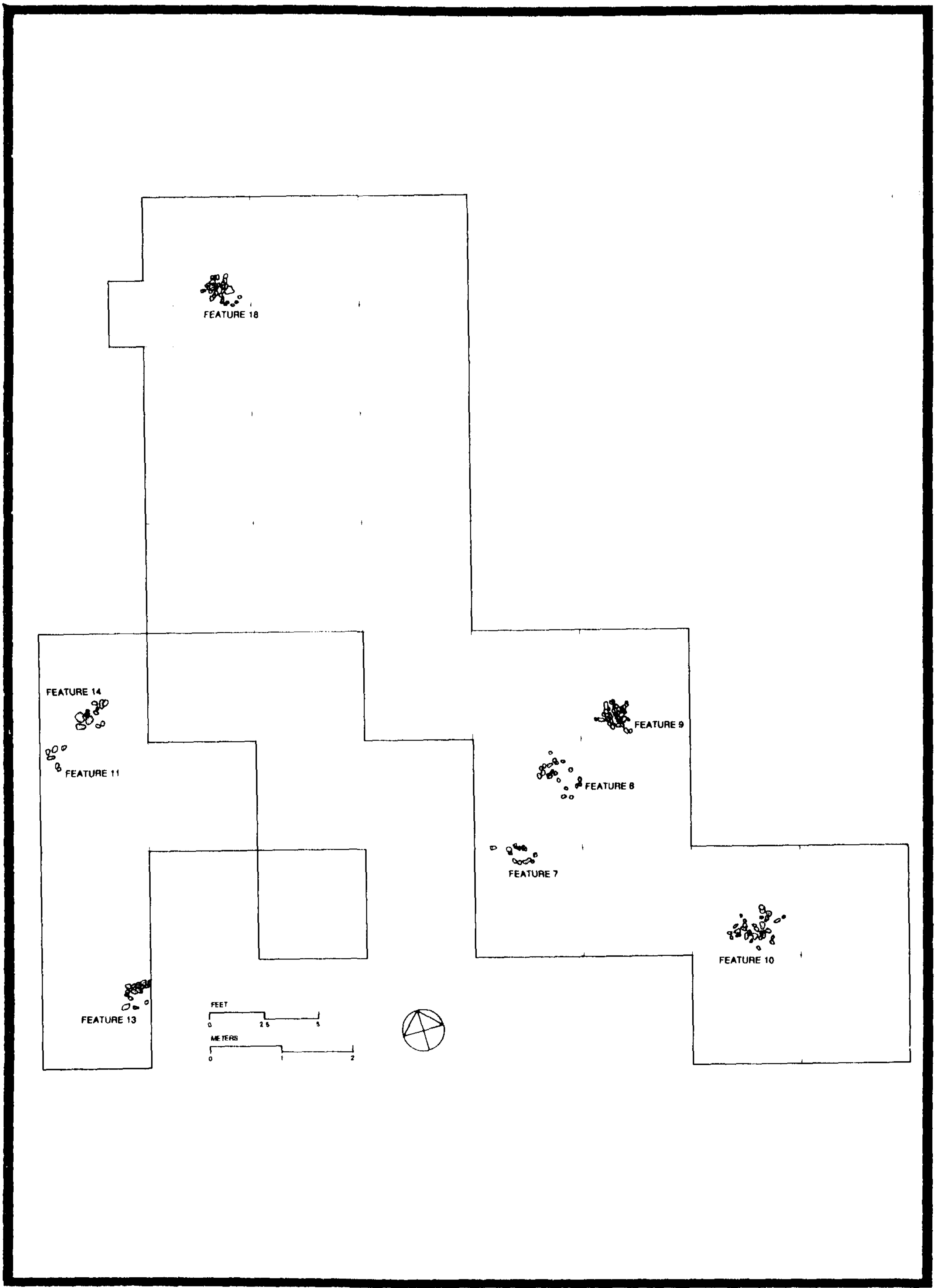


FIGURE 21: Plan View of Features, Excavation Block 5

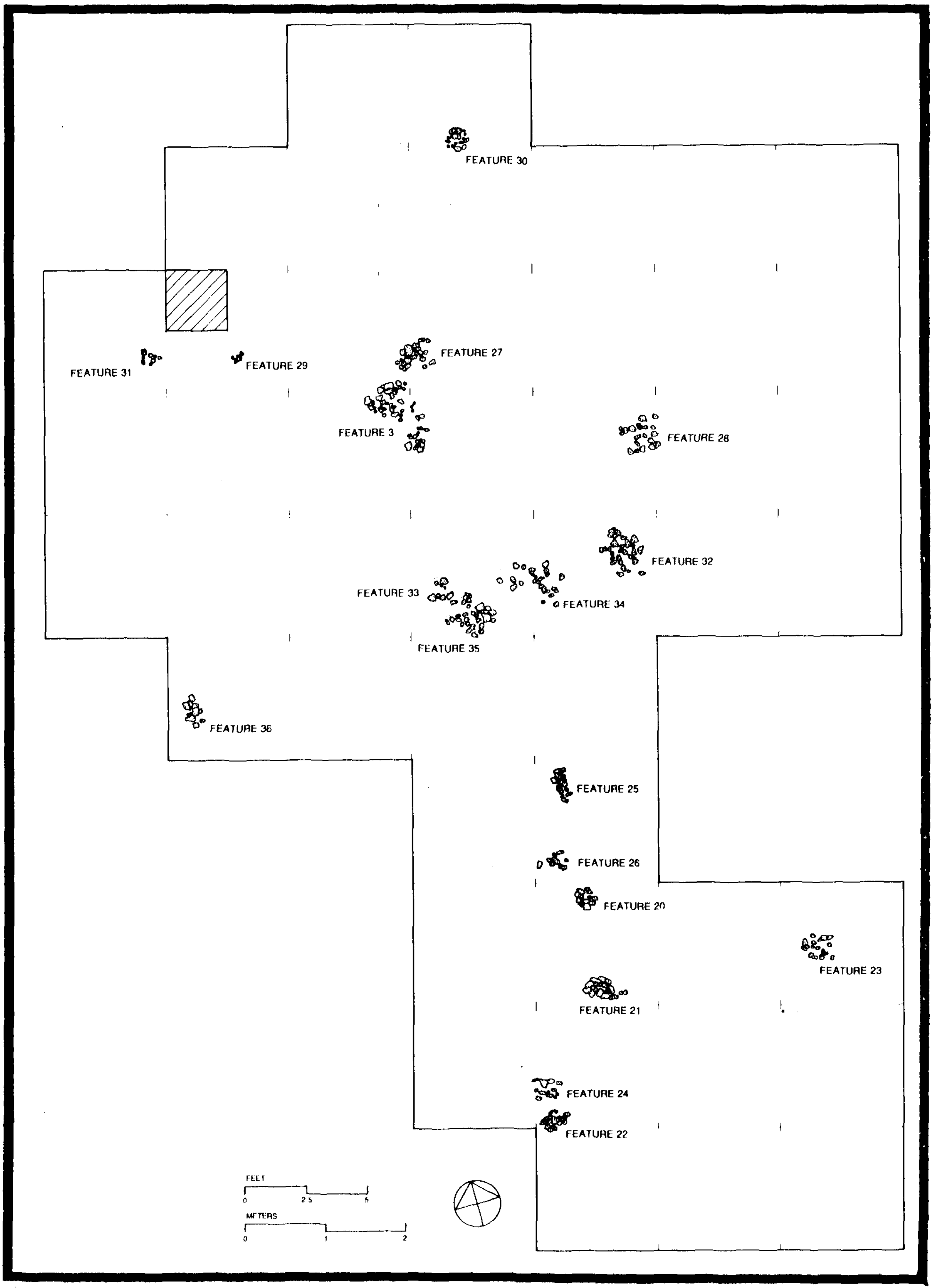


FIGURE 22: Plan View of Features, Excavation Block 6

the subsoil level (Stratum B, Level 2) and extended for a short distance into the second subsoil level (Stratum B, Level 3). The quantity of fire-cracked rock recovered from the plowzone suggests that historic cultivation either truncated many of the extant features that extended into subsoil or destroyed features that may have been confined to near-surface contexts.

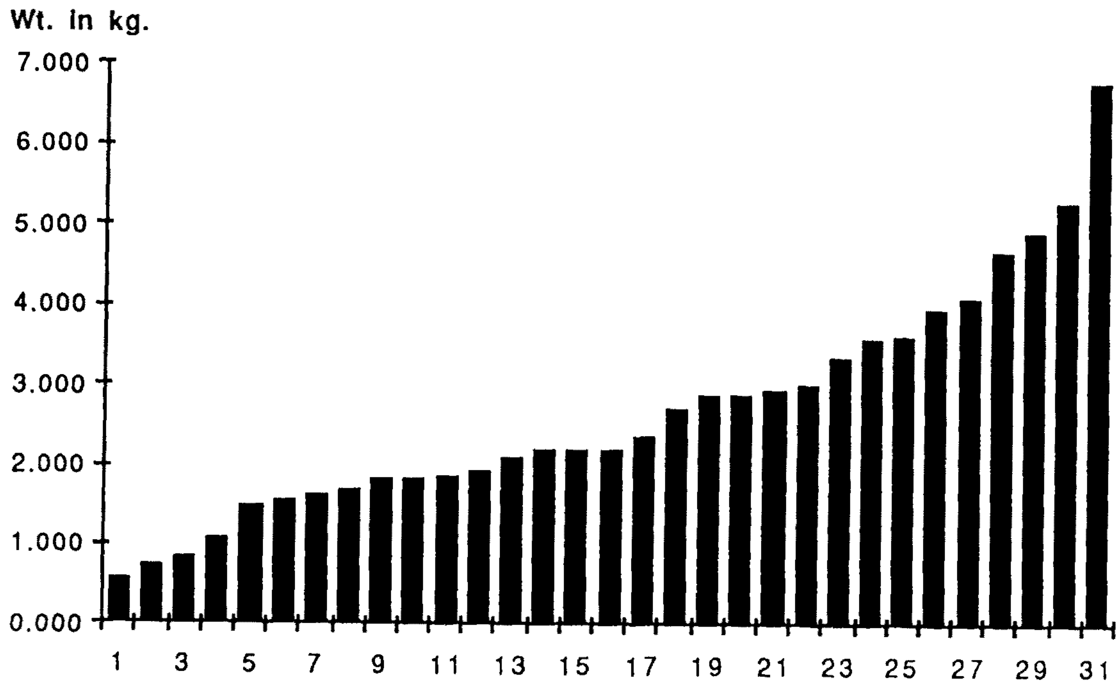
The weights of the FCR features averaged 2.679 kilograms, with a range from 0.587 to 6.788 kilograms (Figure 23); three-fourths of the FCR clusters ranged from 1.4 to 4.1 kilograms in mass. Lithic material represented in the FCR features includes ironstone, quartz, quartzite, gneiss, granite, and schist. By weight, ironstone, quartz, and quartzite account for 99 percent of the FCR features (Table 7). Ironstone alone accounts for nearly three-fourths (74 percent) of the total material in the FCR features, and it is the most plentiful material in 26 of the 31 examples. Five of the FCR clusters (Features 2, 8, 11, 12, and 34) are distinguished by the relative scarcity of ironstone; among this subset, quartzite is the dominant raw material, followed by quartz. Aside from raw material, these features are comparable to the others in terms of their size, weight, and depth of origin, and there is no apparent pattern to their spatial distribution within Area 3.

The FCR features also contained small amounts of lithic debitage, primarily flakes, and a few of the FCR clusters contained tools. Charred botanical material was also recovered from flotation samples taken from the FCR feature contexts (see Chapter IX). For the most part, dating of the FCR features is uncertain, and only 2 of the 31 FCR features contained diagnostic projectile points. Feature 22 contained a Late Archaic Savannah River point, and Feature 32 included an Early/Middle Archaic Stanly point. However, the association of a point dated between circa 6300-5300 BC with Feature 32 does not necessarily imply an equivalent age for that feature. In open surface contexts, temporally diagnostic artifacts provide only a Terminus Post Quem (Noel Hume 1969); therefore, it can be said only that Feature 32 cannot be dated earlier than circa 6300 BC. By the same reasoning, Feature 22 cannot be dated earlier than the Late Archaic. It is notable that Feature 32 originated at a higher depth than Feature 22, which would indicate a greater age for the latter, if one assumes that both features were deposited on an occupation surface that was subject to gradual deposition of alluvium. In this case, the association of an Early/Middle Archaic point with the more elevated feature highlights the difficulty of dating features on an open site with a lengthy occupational history.

In addition to FCR clusters, other features identified in Area 3 included a small charcoal concentration (Feature 6) that provided a radiocarbon date of 4,080 $\pm$ 80 years BP (Beta 32001), a cache of six quartzite bifaces (Feature 29), and two lithic workshop areas (Features 4 and 5) represented by concentrations of cores, decortication flakes, and battered cobbles.

Feature 6, a basin-shaped concentration of charcoal flecks, appeared within the subsoil (Stratum B) of Unit 44. In plan, Feature 6 measured approximately 1.5 feet in diameter and 0.78 foot in depth (Figure 24). Scattered charcoal flecks were evident in the soil surrounding the fFeature area, but there was not evidence of in situ burning such as reddened or baked soil. There was no cultural material associated with Feature 6. Unlike the FCR features, Feature 6 did not appear immediately below the plowzone, as it was initially exposed beneath two subsoil levels (approximately 0.6 foot). The depth of the feature suggests that it may represent the remains of a roasting pit, although no pit walls were evident in the soils overlying the charcoal concentration.

The two lithic workshop areas represented by Features 4 and 5 were both excavated during the Phase II fieldwork. Feature 4 was defined within the upper portion of Stratum B of Unit 32. This unit was placed in the north-central area of the site, where the soils were characterized by abundant gravel and cobble inclusions. The feature was defined by a concentration of cobbles that covered most of the unit but which did exhibit some spatial clustering (Plate 2). The rock concentration was heaviest in the level immediately below the plowzone and disappeared after removal of two excavation levels within Stratum B. Material associated with Feature 4 includes 1 quartz untyped stemmed projectile point, 2 hammerstones, 1 abrading stone, 2 cores, debitage, and fire-cracked



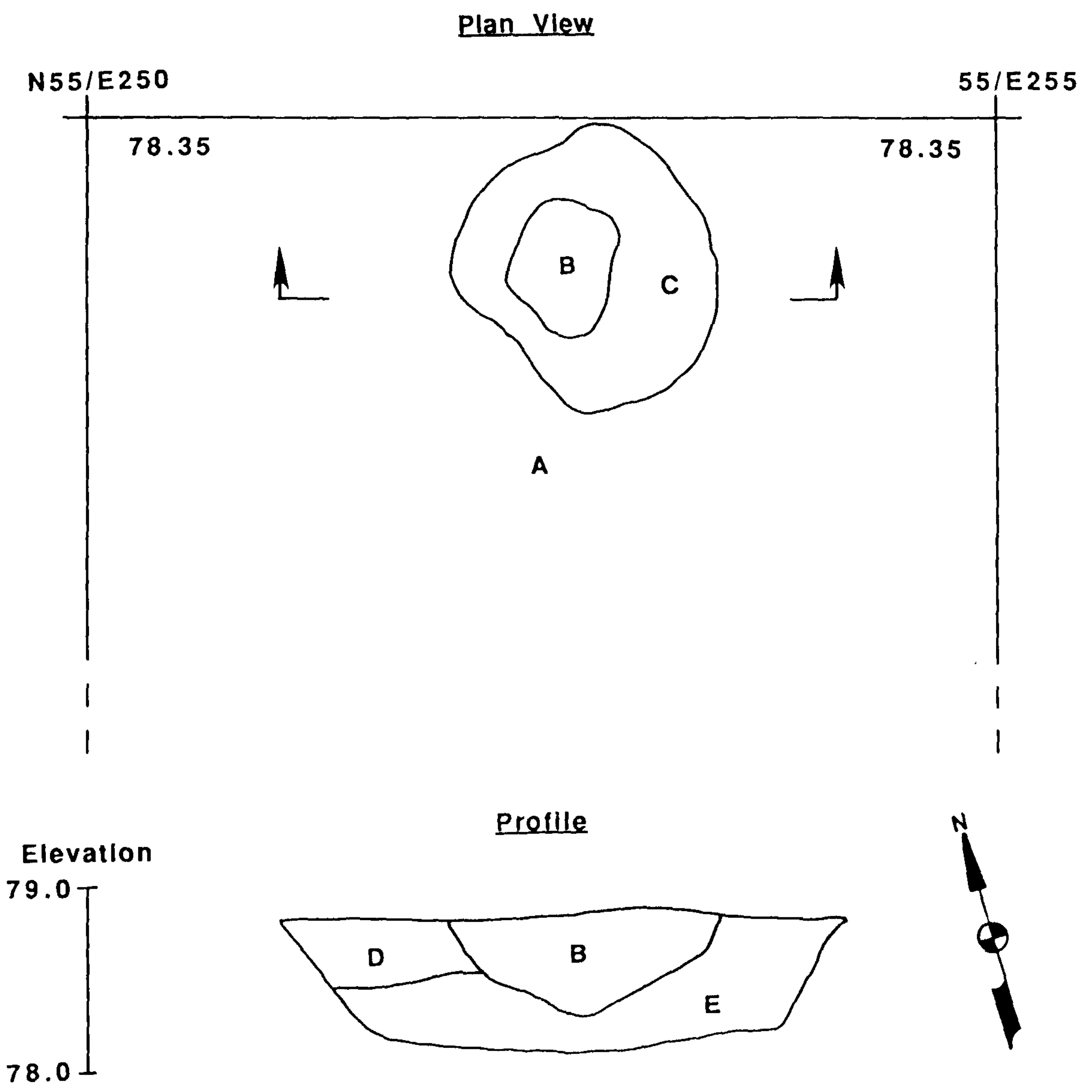
Average weight	2.679 kg
Minimum weight	0.587 kg
Maximum weight	6.788 kg
Standard deviation	1.432 kg

FIGURE 23: Weight Distribution of Fire-Cracked Rock Features

TABLE 7. RAW MATERIAL USED IN FCR FEATURES.

FEAT. NO.	TTL WT.	IRON-STONE WT.	%	QUARTZ WT.	%	QUART-ZITE WT.	%	OTHER WT.	%
2	4.687	1.423	30	1.242	26	2.022	43	.	.
3	5.282	4.264	81	.	.	1.018	19	.	.
7	0.736	0.624	85	.	.	0.058	8	0.054	7
8	1.950	.	.	0.611	31	1.339	69	.	.
9	6.788	3.723	55	0.947	14	2.017	30	0.101	1
10	3.037	2.958	97	.	.	0.079	3	.	.
11	0.587	.	.	0.293	50	0.294	50	.	.
12	3.641	1.338	37	0.622	17	1.681	46	.	.
13	1.493	0.868	58	0.162	11	0.463	31	.	.
14	1.564	1.376	88	0.077	5	0.111	7	.	.
15	1.630	1.368	84	0.160	10	0.102	6	.	.
16	2.192	1.492	68	0.341	16	0.359	16	.	.
17	3.983	3.887	98	0.001	.	0.095	2	.	.
18	4.925	4.351	88	.	.	0.574	12	.	.
19	2.726	2.726	100	.	.	.	.	.	.
20	1.706	1.433	84	0.049	3	0.224	13	.	.
21	4.117	3.987	97	.	.	0.130	3	.	.
22	2.207	1.535	70	0.200	9	0.472	21	.	.
23	1.837	1.515	82	0.186	10	0.136	7	.	.
24	1.818	1.035	57	0.381	21	0.402	22	.	.
25	1.880	1.383	74	.	.	0.497	26	.	.
26	1.072	1.019	95	.	.	0.053	5	.	.
27	3.589	3.560	99	.	.	0.029	1	.	.
28	2.110	1.920	91	0.018	1	0.172	8	.	.
30	3.349	3.349	100	.	.	.	.	.	.
31	0.851	0.851	100	.	.	.	.	.	.
32	2.197	2.079	95	.	.	0.118	5	.	.
33	2.871	2.791	97	.	.	0.080	3	.	.
34	2.876	0.478	17	0.117	4	2.281	79	.	.
35	2.959	2.953	100	.	.	0.006	0	.	.
36	2.391	1.317	55	.	.	1.011	42	0.063	3

Note: all weights expressed in kg.



STRATA KEY

A Top of Stratum B, Level 4; mottled yellowish brown (10YR 5/8) loamy sand.
B Feature 6; very dark grayish brown (10YR 3/2) stain with charcoal flecks.
C Feature 6; mottled yellowish brown (10YR 5/6) and gray (10YR 5/1) loamy sand.
D Yellowish brown (10YR 5/8) loamy sand.
E Strong brown (7.5YR 5/8) loamy sand.

FIGURE 24: Feature 6, Plan and Profile

rock. During the Phase III fieldwork, a block of units surrounded Unit 32 to expose additional features and activity areas, but no other features were identified in this block.

Feature 5, a lithic reduction area or workshop, was identified initially in the second subsoil level below the plowzone in Unit 35. The feature was defined by a scatter of battered cobbles (functional stage cores and hammerstones) mixed with unmodified cobblestones, flakes, and other items. The tools and debitage were confined primarily to the northern half of the unit (see Figure 19). Unit 35 was placed within the north-central area of the site, which was occupied by a gravel bar, and a dense gravel/cobble deposit was encountered directly beneath the feature. During the Phase III fieldwork, a block of units was place around Unit 35 to expose additional features and activity areas around Feature 5. Two FCR clusters (Features 15 and 16) were also identified in this block.

Feature 29 was a cache of 6 quartzite bifaces (Plate 3) representing the early, middle, and late stages of reduction (Callahan 1979). The adjacent levels within Unit 144 also contained 2 cores and 3 additional bifaces that may have been associated with Feature 29.

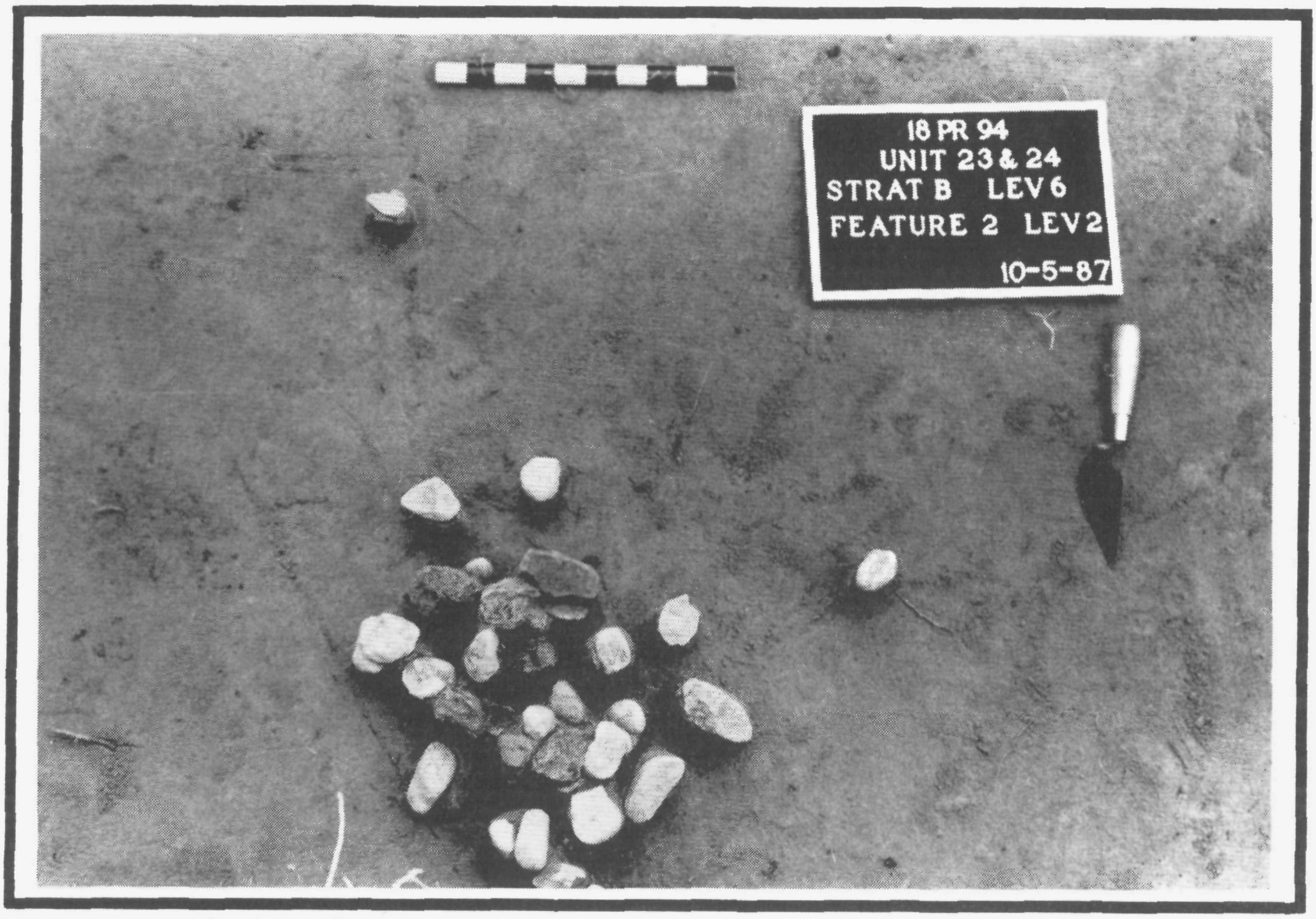


PLATE 1: **Feature 2**

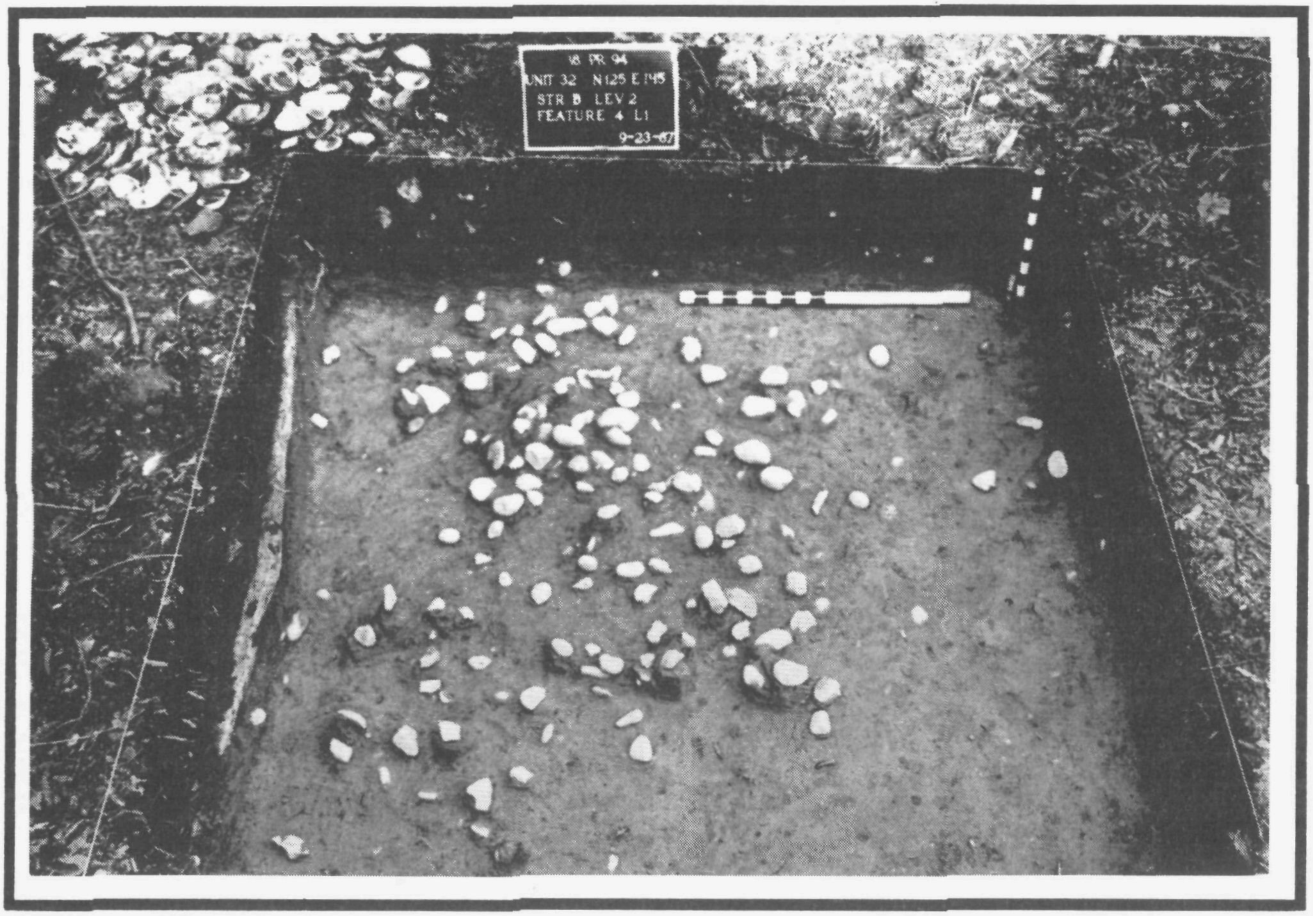


PLATE 2: **Feature 4**

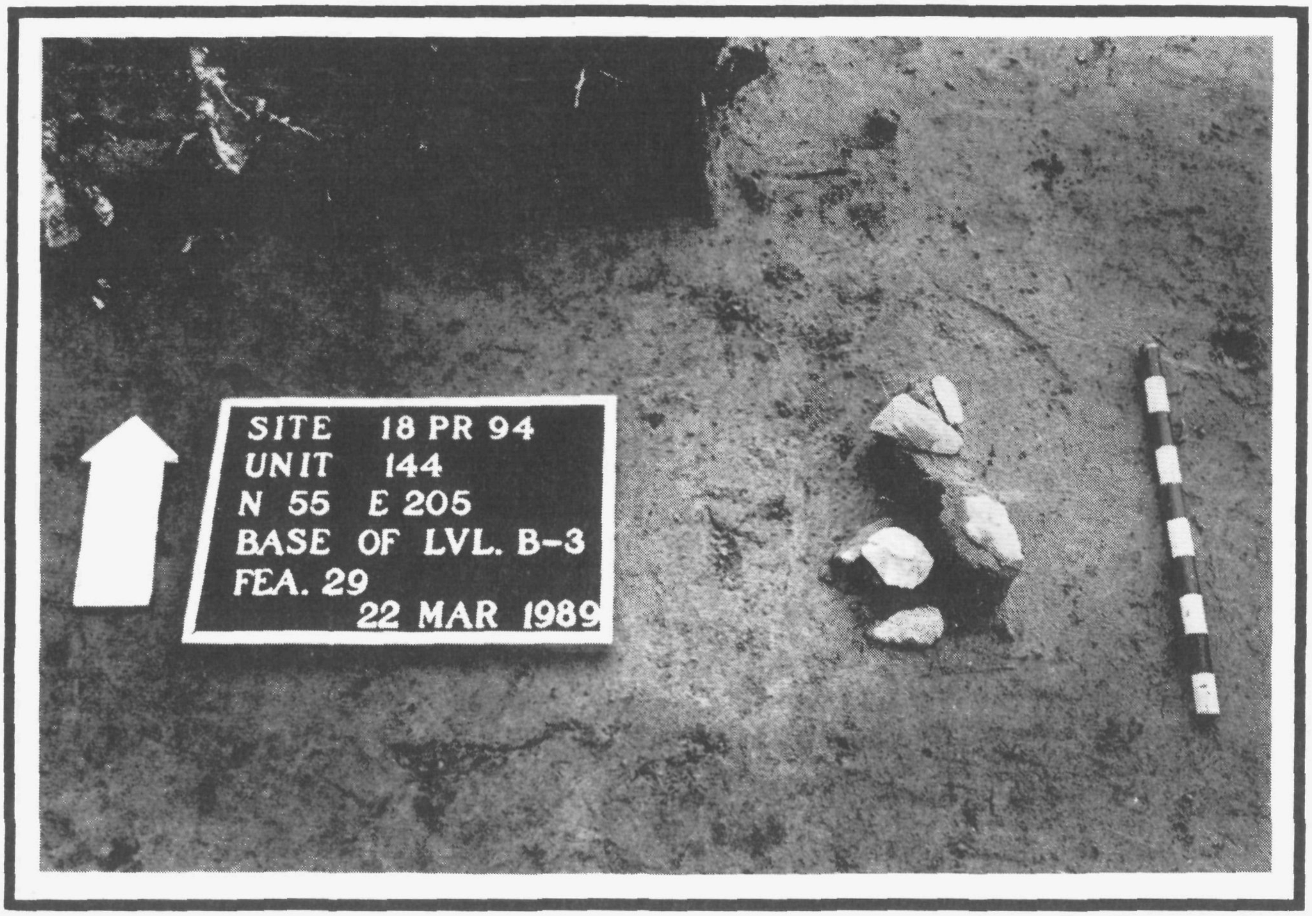


PLATE 3: Feature 29

VII. LITHIC ANALYSIS

A. INTRODUCTION

Lithic tools and debris make up the entire prehistoric artifact assemblage recovered from the Indian Creek Site. Just under 60,000 lithic artifacts were recovered from all phases of work conducted at the site. The majority of these artifacts were generated by the Phase III investigations, and all diagnostic artifacts fall within the Archaic period. This chapter uses lithic data from all phases of the work to address a series of research questions that examine issues of technology, function, style, and raw material selection and that furnish insights not only into the Archaic occupation of the Indian Creek Site but also into the Archaic occupation of Maryland and the Middle Atlantic region as a whole. The research questions are outlined in the next section, which is followed by a summary of the analytical methods. The results of the lithic analysis are presented in four sections, entitled Cultural Components; Lithic Procurement; Lithic Industries and Site Activities; and Residue Analysis. The concluding section summarizes the results of the analysis by answering the research questions.

B. THEORETICAL ORIENTATION AND RESEARCH QUESTIONS

Lithic artifacts are durable by-products of human behavior. As such, they represent the longest and most continuous record of human behavior, particularly economic behavior. The economy of a society or culture can be defined as the process by which that society provisions itself. Technology is the means by which provisioning is achieved and maintained. Thus, changes in technology provide direct insights into changes in economy.

Stone tools and the debris from their manufacture, maintenance, and recycling comprise the lithic record of a society. This record is a partial reflection of a society's technology--its strategies for interacting with its biophysical and social environments. The organization of technology is the way in which a society designs its tools and structures tool production, use, maintenance, and recycling, so that the tools can function effectively in response to the demands placed upon them by a society (Koldehoff 1987; see also Binford 1983b). How a society or culture organizes its technology is dependent upon factors such as settlement mobility. For example, in mobile hunter-gatherer societies, organizational responses to settlement mobility appear to be well represented in the lithic record, and transportation costs appear to be the most limiting factors (e.g., Binford 1983b; Kelly 1988; Parry 1989; Parry and Kelly 1987; Torrence 1983; Shott 1986).

The organization of a society's lithic technology can be exposed by defining specific industries: "an industry is a manufacturing or productive enterprise focusing on a raw material and involving certain common means of processing that material" (Sheets 1975:372). With this concept of industry, an overall chipped-stone industry and an overall groundstone industry can be defined, as can more specific industries, such as a biface industry and a flake-tool industry (e.g., Koldehoff 1987, 1990a; Parry 1987).

By delineating lithic industries, the technological organization of a society's economy can be investigated. However, the lithic record of an extinct culture or society is not easily observed or studied because the formation of the archaeological record in general, like the formation of any archaeological site, is a complex process involving both cultural and noncultural (natural) factors (Binford 1983b; Schiffer 1976, 1987). These factors over the course of time mingle deposits and "distort" artifact patterning, complicating attempts to make observations about discrete aspects of past human behavior. Because lithic artifacts are durable, they accumulate on living surfaces; and unless these surfaces or features are buried soon after each occupation and remain sealed, the tools and debris from different occupations are likely to become mixed.

In addition, the stone tools that are discarded or abandoned at a site do not necessarily accurately reflect all site activities. Stone tools go through a life cycle of production, use, maintenance, and discard (Figure 25), but these phases may not all occur at the same site. Similarly, different tool types have different uselives: some tools are designed to be used and immediately discarded (expedient tools), while others are designed to be used and maintained for an extended period of time (curated tools) (see Binford 1983b). As a result, mobile hunter-gatherers tended to use and discard curated tools (e.g., hafted bifaces) at a series of locations across the landscape, while expedient tools (e.g., flake knives and cobble manos) tend to be used and discarded at the same location.

At the Indian Creek Site, the lack of clear vertical and horizontal separation of the various Archaic occupations reduces the level of detail at which shifts in Archaic technology, subsistence, and site organization can be examined. At the same time, this lack of stratigraphic separation underscores the importance of the temporally diagnostic artifacts (e.g., hafted bifaces). In most cases, the least diagnostic artifacts, such as debitage and fire-cracked rock (FCR), cannot be confidently assigned to specific components. The paucity of subsistence remains, particularly bone, focuses attention on the potential subsistence information that can be gleaned from the lithic assemblage. Toward this end, an aggressive residue analysis program was undertaken.

The general or overall objective of the lithic analysis was to quantify and describe the lithic artifacts recovered from the site. Specific research questions are listed below under the headings Technology and Function; Style; and Raw Material Selection. Each of these aspects of the lithic record is related to, and cannot be completely divorced from, the others--as will be apparent from the research questions. Lacking clearcut stratigraphic separation of individual occupational components, most of the research questions can be examined only at the level of the site. Site structure and intrasite patterning are examined in Chapter VIII.

1. Technology and Function

For this study, technological analysis specifically refers to the identification of the methods and techniques used in stone tool production, maintenance, and recycling; and functional analysis refers to the identification of the tasks for which stone tools were used. The examination of the following questions also provides information about site function and structure.

a) In general, what was the range of activities performed at the site?

b) Specifically, what kinds of stone tools were manufactured, maintained, and recycled at the site, and what kinds of subsistence tasks or other activities appear to be represented?

c) Does the range of activities change through time?

d) Are plant and/or animal residues preserved on the surfaces of the stone tools recovered from the site; if so, how do these residues match the functional classification of each tool, which is based upon morphology and use-wear?

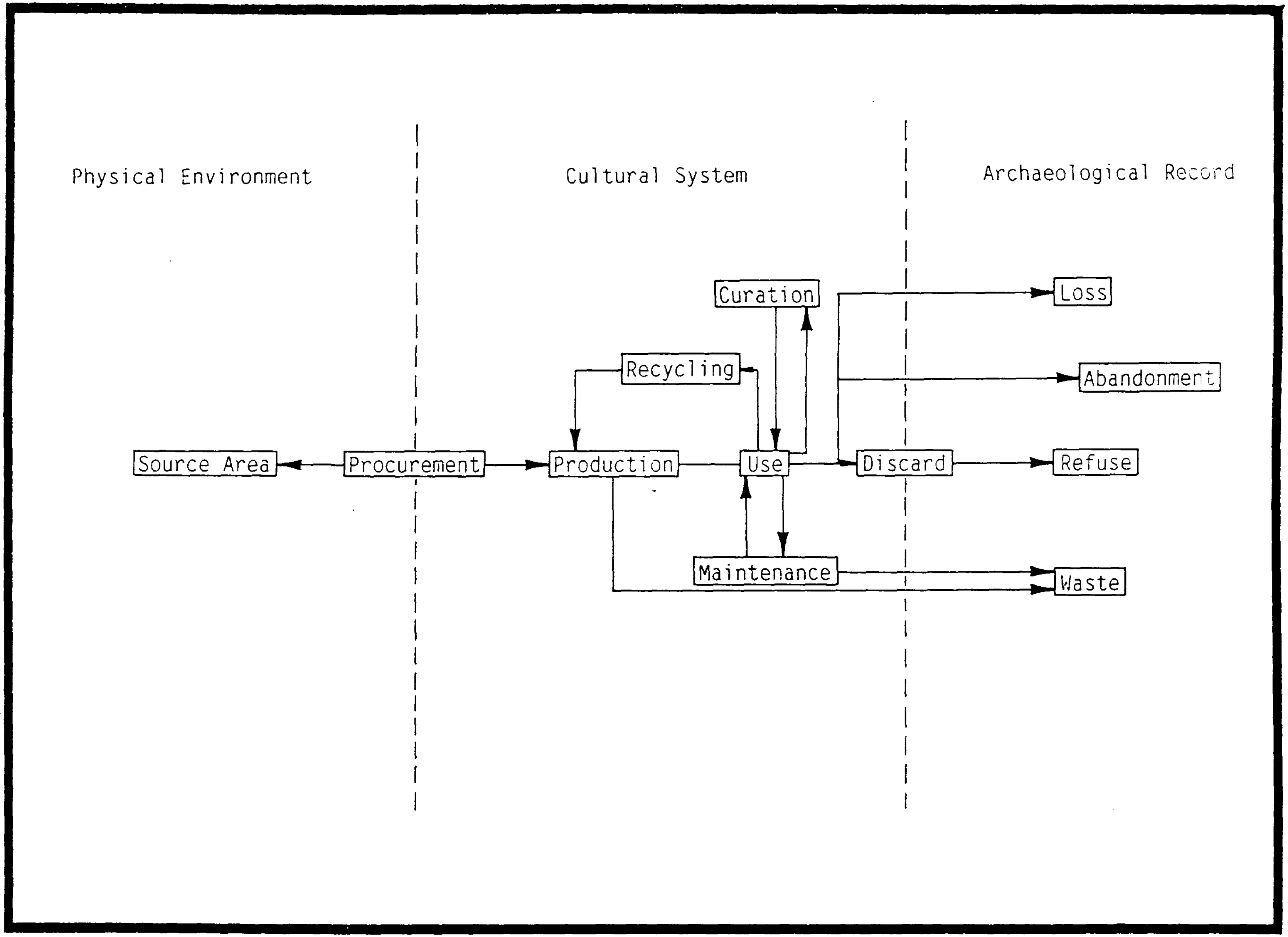


FIGURE 25: Simplified Flow Model of the Life Cycle of Lithic Materials in a Cultural System

2. Style

Stylistic or typological analysis concentrated on the hafted bifaces. These artifacts are the most temporally sensitive and thus provide the best assessment of the cultural components at the site and their regional or ethnic affiliations.

a) What cultural components are represented at the site?

b) How intensive were these occupations?

3. Raw Material Selection

Both technological and social factors influenced the selection of raw materials. Specific raw materials exhibit distinctive physical properties; these properties had to be considered in tool production--both in design and in execution.

a) What raw materials were used in tool production?

b) Are raw material preferences apparent in the hafted bifaces; if so, do they change through time?

c) Which materials were locally available, and which materials were obtained from distant sources?

d) Were materials from distant sources acquired via exchange networks, or were they procured as part of a broader settlement strategy?

C. ANALYTICAL METHODS

To facilitate the investigation of the research questions, data from all phases of work were combined into one large database. Two steps were taken to ensure comparability of data between the initial phases of work (see LeeDecker et al. 1988) and the Phase III work. First, the same artifact coding system that was used in the earlier analysis was used in the Phase III lithic analysis. Second, portions of the Phase I and II collections were reexamined to reduce observer error (i.e., inconsistencies in artifact coding, resulting from coding by different analysts). Similarly, the Phase III debitage and FCR were reexamined to reduce observer error because these artifact classes were coded by several technicians at different times. Some differences between the Phase I and II data and the Phase III data do exist, but they do not affect the investigation of the research questions.

All artifacts from all units of collection, including flotation samples, were subjected to technological/functional analysis and raw material analysis. Only hafted bifaces were subjected to stylistic analysis. Fortuitous crossmends (those found during analysis) were recorded, and special attention was given to potential crossmends between hafted bifaces. Basic information about the coding system and the nature of the database can be found in Chapter IV and Appendix E. A general inventory of the lithic assemblage is contained in Appendix F. Detailed inventories of the various artifact classes are listed in Appendices G through M.

1. Raw Material Analysis

Raw materials were identified on the basis of macroscopic characteristics: color, texture, hardness, inclusions, and cortex. A 10X hand lens (and on occasion higher levels of magnification) was used to identify inclusions, for example, fossils in cherts and phenocrysts in rhyolites. Geological and archaeological type specimens housed at the LBA archaeology laboratory in East Orange, New Jersey, were used for comparative purposes, and a sample of cobbles was collected from Indian Creek for comparative purposes. It should be noted that one specimen of an unusual raw material (sandy chert) was thin-sectioned and subjected to petrographic analysis by Mr. John Fox, Staff Mineralogist at Ward's Natural Science Establishment, Inc., Rochester, New York. Raw material analysis placed artifacts into 21 different types and noted the presence or absence of cortex and intentional thermal alteration (heat treatment). A descriptions of each raw material type follows.

a. Quartz

Quartz exhibits a conchoidal fracture pattern and is one of the most common minerals in the earth's crust. Two varieties of quartz were recovered from the site, vein quartz and transparent rock quartz crystal. Both varieties are formed from igneous magma and hydrothermal veins. Rock quartz crystals are large individual crystals, while vein quartz occurs as seams of interlocking crystals or massive crystalline structures. Vein quartz dominates the assemblage; rock quartz crystal is limited to a few pieces of debitage. Specimens of vein quartz are, on occasion, partially transparent, but more often than not they could be described as cloudy or even opaque and white to light gray in color (i.e., milky quartz). A few specimens of vein quartz are pinkish and could be referred to as rose quartz. For the remainder of the report, vein quartz will simply be referred to as quartz.

b. Quartzite

Quartzite exhibits a conchoidal fracture pattern and has been traditionally defined as metamorphosed sandstone. Heat and/or pressure transformed the sandstone into a more homogeneous matrix, which more readily transmits fractures through individual sand grains rather than around them. Research by geologists, however, has shown that many quartzites are not the product of metamorphism; rather, quartzites are of two basic types: sedimentary and metamorphic (see Ebright 1987). Sedimentary quartzites (or orthoquartzites) are more common than metamorphic quartzites (or metaquartzites), and they can be described as sandstones that have been cemented together by various agents, rather than transformed by heat and pressure. The flaking quality of orthoquartzites varies depending upon their type and degree of cementation: the more weakly cemented, the poorer the flaking quality. Even the best orthoquartzites and metaquartzites can be considered coarse-grained and difficult to flake when compared to more homogeneous or isomorphic materials like chert and jasper (see Callahan 1979). A variety of quartzites are represented at the site, but most specimens are comparable to the medium-grained brown, gray, purple, and red orthoquartzites from the Piney Branch source in Washington, D.C. (Ebright 1987:36; Holmes 1897). The level of effort required to distinguish different forms of quartzite accurately exceeds the limits of this project (see Ebright 1987).

c. Ironstone

For the purpose of this study, ironstone is defined simply as iron-rich sandstone. Deposits of similar materials are a common feature of the Coastal Plain, and because of their depositional history, such materials have been referred to as "bog iron" (see Vokes and Edwards 1957; Ward 1988). In the assemblage, ironstone primarily occurs as oddly shaped lumps and slabs that appear to have been collected locally and directly used in cooking and heating facilities. In a few cases, suitable pieces of ironstone were flaked, but local deposits evidently do not possess the same flaking quality as ironstone deposits on the Delmarva Peninsula (see Ward 1988).

d. Rhyolite

Rhyolite is a fine-grained extrusive igneous rock that can be conchoidally fractured. One of its most distinguishing features is quartz and feldspar phenocrysts, which are scattered throughout its matrix. Much of the rhyolite in the Indian Creek assemblage is macroscopically indistinguishable from rhyolite deposits in the South Mountain area of northern Maryland and southern Pennsylvania (R. Michael Stewart, personal communication 1990). Because of this similarity and because the South Mountain area (approximately 100 km to the northwest) is the closest known source of rhyolite, it is likely that South Mountain is the source of the rhyolite at the Indian Creek Site. The exploitation of South Mountain rhyolite has been documented by R. Michael Stewart (1984a, 1984b, 1987, 1989b). Furthermore, Stewart has described several varieties of South Mountain rhyolite (1984a:4), and he provided assistance in the identification of these varieties in the Indian Creek assemblage. It should be noted that South Mountain rhyolite is actually a metarhyolite; that is, it has been metamorphosed. In general, this process increased flaking quality and imparted distinctive macroscopic characteristics, which help to separate it from rhyolites in adjacent regions.

e. Sandy Chert

Sandy chert is a distinctive raw material that can best be described as an earthy colored chert matrix which contains varying amounts of sand-sized particles of quartz. Under 10X magnification, it is evident that various sizes of quartz particles are contained in the matrix. The largest particles do not exceed 2.5 millimeters, and most particles fall below 1.0 millimeter. Most of the particles are transparent, while a minority are cloudy. The density of the particles ranges from widely scattered to tightly packed, but rarely do they come into contact with one another. If not examined closely, specimens with dispersed particles could be mistaken for rhyolite. The color of the chert matrix is a mottling of several shades of gray, which can be streaked with pink or red: light gray (5Y 7/2), light brownish gray (2.5Y 6/2), pinkish gray (10YR 6/2), and reddish gray (5YR 5/2). The latter colors may or may not be the result of thermal alteration. The presence of possible castings and burrows indicates that this material is probably some form of silicified sediment. This interpretation is substantiated to a degree by John Fox's petrographic analysis of a thin-sectioned specimen of sandy chert (John Fox, personal communication 1990); a photomicrograph of a portion of the thin-section is presented in Plate 4. Fox describes the specimen as follows:

> It is an arenaceous chert with minor amounts of cryptocrystalline clay and/or carbonate grains giving a tan color. Zones of abundant, matrix supported fine to medium subrounded sand (quartz) are separated by irregular regions of microgranular quartz chert. The sand has as an average size of 1/3 mm and the grains are mostly unstained, only a few grains are quartzose lithics, or show undulatory extinction. Fibrous chalcedony and fossils are notably absent.

Further work is required to determine the origins of this unusual material. A similar material was recovered from sites on Piscataway Creek (Gardner 1976) and described as silicified sandstone (R. Michael Stewart and William Barse, personal communication 1990). Technically, the material referred to here as sandy chert is not a silicified sandstone because the sand grains are suspended in a chert matrix.

f. Chert

Chert is cryptocrystalline quartz. Unlike vein quartz and rock quartz crystal, chert tends to occur in sedimentary rocks. In general, chert is very amenable to flaking. A variety of cherts are present in the assemblage, and their potential source areas are examined later.

g. Chalcedony

Like chert, chalcedony is a form of cryptocrystalline quartz. For this study, the term chalcedony is applied to a specific type of fine-grained raw material. Its texture and fracture mechanics differ from the cherts in the assemblage, as does its coloration: white (5Y 8/1), reddish brown (2.5YR 5/3), light grayish brown (2.5Y 6/2), light gray (5Y 6/1), gray (2.5Y 5/0), and very dark gray (2.5Y 3/0). The lighter colored specimens are somewhat translucent, and several colors can be mottled or streaked together. The source of this material has not been identified, but it appears to have been redeposited locally, like the quartz and quartzite in the assemblage.

h. Jasper

Jasper is another form of cryptocrystalline quartz. The jasper recovered from the site is fine-grained and tan to brown in color. There are several known sources of jasper in the region (e.g., Fanale 1974; Hatch and Miller 1985; Klimkiewicz and Scheetz 1990), but none of the material in the assemblage has been linked to a particular source.

i. Argillite

Argillite is indurated mudstone or claystone, which, because of its fine texture and hardness, can be flaked. Large deposits of argillite are common in the Middle Atlantic region (Didier 1975). The argillite artifacts in the assemblage compare favorably with argillites from the Delaware Valley, but the ultimate source of these items is uncertain. All of the argillite artifacts are highly weathered with a chalky exterior.

j. Siltstone

Siltstone is a rather fine-grained sedimentary rock. Materials that are more coarsely grained than argillite but more finely grained than sandstone were considered siltstone. Only a small number of specimens were identified, and all appear to be FCR.

k. Sandstone

Sandstone is composed of cemented sand grains. The few artifacts in the assemblage that have been identified as sandstone may actually be a low-level orthoquartzite or silicified sandstone.

l. Granite and Gabbro

These materials are coarse-grained igneous rock and are represented in the assemblage by several fragments of FCR. The likely source of these materials is the Piedmont.

m. Basalt

Basalt is a fine-grained igneous rock that can be conchoidally fractured. One flake and one fragment of FCR from the site appear to be basalt or some related igneous material (e.g., diabase).

n. Schist and Gneiss

These materials are coarse-grained metamorphic rocks, which occur in the assemblage primarily as fragments of FCR. The primary source of these materials is undoubtedly the Piedmont.

o. Serpentine

As the term is used here, serpentine refers to relatively fine-grained metamorphic "greenstones." In the assemblage, four small fragments of groundstone tools were assigned to this raw material type.

p. Steatite

Steatite or soapstone is a fine-grained compact metamorphic rock, whose principal constituent is talc. This soft but durable material is ideal for manufacturing stone bowls and other groundstone implements. Steatite quarries have been reported from Washington, D.C., as well as from other areas of the Middle Atlantic (Holland et al. 1981; Holmes 1897; Luckenbach et al. 1975).

q. Hematite and Limonite

Hematite and limonite are two forms of iron ore; the latter is of a lower grade and is more earthy in appearance. The source of these materials is uncertain. The locally occurring deposits of ironstone are a possible source, but none of these specimens contains the sand grains typically found in ironstone.

r. Petrified Wood

This material is represented in the collection by two small unmodified cobbles. It is likely that these pieces were collected from local gravel deposits and abandoned at the site by its inhabitants.

2. Technological and Functional Analysis

The analytical approach applied to the Indian Creek assemblage can best be described as technomorphological; that is, artifacts were grouped into general classes and then further divided into specific types based upon key morphological attributes, which are linked to or are indicative of particular stone tool production or reduction strategies. Function was inferred from morphology as well as from use-wear. Data derived from experimental and enthnoarchaeological research were relied upon in the identification and interpretation of artifact classes and types. The work of Callahan (1979), Clark (1986), Crabtree (1972), Flenniken (1981), Gould (1980), and Parry (1987) were basic sources.

The entire lithic assemblage can be divided into chipped-stone tools and debris and groundstone tools and debris (except for two unmodified pieces of petrified wood). Chipped-stone and groundstone tools were identified on the basis of morphology and use-wear, based on prior experiments in stone tool production and use (e.g., Koldehoff 1990a, 1990b). Surfaces and edges were examined with the unaided eye and with a 10X hand lens for traces of use polish and damage. A conservative approach to the identification of utilized and edge-retouched flake tools was taken for two reasons: because use-wear is difficult to detect on quartz (Flenniken 1981; Parry 1987), and because a number of processes can create edge damage/retouch in addition to intentional use or modification, for example, trampling of living surfaces, spontaneous retouch during flake detachment, and trowel and shovel damage. Similarly, a conservative approach to the identification of cobble tools was taken because it is difficult to separate minimally used cobble hammers or manos from naturally smoothed and battered cobbles. Admittedly, this "low-power" approach to functional analysis is less accurate and precise than approaches that employ high magnification (e.g., Keeley 1980; Yerkes 1987); but, given the research questions and the nature of the database, this method is adequate. Additional functional information was derived from residue analysis. An array of both chipped-stone and groundstone tools and debris was examined for plant and animal residues. The methods and the results of this analysis are discussed in Section G.

a. <u>Chipped-Stone Tools and Debris</u>

1) Bifaces

A biface is a flake or cobble that has had multiple flakes removed from the dorsal and ventral surfaces. Bilateral symmetry and a lenticular cross section are common attributes; however, these attributes vary with the stages of production, as do thickness and uniformity of edges (see Callahan 1979). Included in this category are all hafted and unhafted bifaces that functioned as projectile points and/or knives, as well as bifacially worked drill bits and unfinished bifaces. Specific types of bifaces are described in the results section of this chapter; length, width, and thickness measurements recorded from intact or nearly intact bifaces were in millimeters.

2) Unifaces

A uniface is a formalized chipped-stone tool fashioned from a flake by uniformly retouching its edges to create a specific working edge and a standardized shape. There are two basic types of unifaces--endscrapers and sidescrapers. In the former, the working edge is transverse to the long axis of the tool; in the latter, the working edge (or edges) parallels the long axis of the tool. Length, width, and thickness of intact or nearly intact unifaces were recorded in millimeters.

3) Modified Flakes

Utilized and edge-retouched flakes are informal expedient tools. They are flakes that were struck from a core or a biface and used to perform one or more tasks, with little or no prior modification. In some cases, it is difficult to distinguish intentional retouch from use damage. The maximum dimension of intact or nearly intact utilized flakes was recorded in 10-millimeter increments by placing the tool on a template of concentric circles, with the unit in the center of the template measuring only 5 millimeters in diameter.

4) Cores

Cores are cobbles or blocks of raw material that have had one or more flakes detached and that have not been shaped into tools or used extensively for tasks other than as a nucleus from which flakes have been struck. Three types of cores were identified: tested cobbles, bipolar cores, and multidirectional (freehand) cores. These types are described in later sections. The weight of all cores was recorded to the nearest gram.

5) Chunks

Chunks (or angular shatter) are blocky fragments of debitage that do not possess striking platforms or bulbs of percussion. Generally the result of uncontrolled fracturing along inclusions or internal fracture planes, angular shatter is frequently produced during the early stages of core and biface reduction. Angular shatter is a common by-product of bipolar reduction, and it is equivalent to Binford and Quimby's (1963) "primary shatter." The weight of each chunk was recorded to the nearest gram, and the maximum dimension was recorded in 10-millimeter units in the same fashion as for the utilized flakes and unmodified flakes.

6) Flakes

Flakes are produced when a material fractures in a conchoidal pattern. Flakes exhibit striking platforms and bulbs of percussion, among other attributes (see Crabtree 1972). In this analysis, intact and fragmentary flakes were recorded separately, but maximum dimensions were recorded for both (with the 10-millimeter-increment template discussed above). No attempt was made to sort flakes into types related to lithic reduction strategies (e.g., biface reduction stages) because this approach was not taken in the Phase I and II analysis and because vast numbers of flakes were recovered but none could be unequivocally linked to individual components. However, the intersection of information about cortex and flake size furnishes general data about lithic reduction (Patterson 1982; Sullivan and Rosen 1985). It should be noted that inconsistencies exist in the database regarding the cataloging of broken flakes and chunks in that chunks were not always distinguished from broken flakes.

b. Groundstone Tools and Debris

1) Formal Groundstone

Formal groundstone tools and ornaments--such as axes, bannerstones, and pendants--were manufactured by pecking, by grinding, and sometimes by flaking. Few artifacts in the assemblage fit into this category.

2) Cobble Tools

Cobble tools are informal expedient tools that were used for various tasks with little or no prior modification. Cobbles appear to have been selected for specific tasks based upon their size and shape. Battered, crushed, pitted, and/or ground surfaces indicate that cobbles were used as hammers, anvils, manos, or for a combination of these functions. Individual types of cobble tools are described in later sections. The weights of cobble tools were recorded to the nearest gram, while length, width, and thickness were measured in millimeters.

3) Fire-Cracked Rock (FCR)

Fire-cracked rock includes all fragments of lithic debris that cannot be attributed to tool production. Generally, fire-cracked rock was recognized by surfaces that exhibited reddening and irregular breakages. Whether a broken cobble was actually fractured as a result of thermal stress is often difficult to discern. For this study, all fractured cobbles were considered FCR, even if they exhibited no clear signs of having been thermally altered. The weight of all FCR was recorded to the nearest gram.

3. Stylistic Analysis

As previously stated, only hafted bifaces were stylistically analyzed. At this juncture, it is important to stress that hafted bifaces are highly formalized tools that were very portable and were designed to be maintained and reused. Micro-wear analysis of Archaic bifaces from the Mississippi Valley (Yerkes 1987) has demonstrated that these tools were employed in varied tasks (see also Ahler 1971). Kelly (1988) also discusses the various roles that hafted bifaces can play as a flexible component of a mobile tool kit. Christenson (1986) has delineated the morphological constraints of chipped-stone bifaces as projectile points; as he emphasizes, hafted bifaces are only one component of a compound projectile (i.e., point, foreshaft, and main shaft) and a specific delivery system (e.g., atlatl or bow and arrow). The presumption is that hafted bifaces are dynamic entities because they are designed to be reusable and flexible, and attempts by archaeologists to construct meaningful topologies must take this fact into account.

The effects of resharpening and recycling on hafted biface morphology should not be underestimated, but at the same time, they do not negate the usefulness of hafted bifaces as "index fossils" of past cultures (see Bettinger et al. 1990; Flenniken and Raymond 1986; Flenniken and Wilke 1989; Thomas 1986). A review of the literature indicates that many researchers in the Middle Atlantic have failed to consider the effects of resharpening and recycling. More often than not, bifaces are sorted into various types as if they were static entities. Hafted bifaces are not invariable: they have long use-lives, and each individual biface has not necessarily experienced the same number of impact fractures or resharpening events. Full recognition of this factor may help to alleviate some of the confusion and difficulty experienced in establishing a valid Archaic projectile point sequence for Maryland and the Middle Atlantic region (see Custer and Bachman 1986; Evans 1984; Evans and Custer 1990; Wesler 1983, 1985). Obviously, a deeply stratified site with numerous points and associated radiocarbon dates would solve many problems. But, like the Indian Creek Site, most excavated sites in the Coastal Plain have shallow and/or mixed deposits.

The procedures that were used to establish the hafted biface typology for the Indian Creek Site were simple and based upon the premise that bifaces are dynamic entities. Bifaces were segregated into groups on the basis of like morphology and technology. Technology refers to those aspects of production, maintenance, recycling, and hafting that are "recorded" or "preserved" on the surfaces of each specimen. Raw material was not considered a variable, except to the degree in which different materials may have affected morphology because of their varying fracture mechanics (see Callahan 1979). Bifaces were not directly assigned to specific point types. Initially, the regional literature was reviewed to gain a sense of the variability in established point types. Subsequently, hafted bifaces were sorted into technomorphological groups (which were independent of established point types); then these groups were compared to established point types to find a "best fit." Within-site provenience (vertical or horizontal) was not considered. The results of the analysis are presented in the following section, along with specific details about the analysis.

D. CULTURAL COMPONENTS

In total, 568 bifaces were recovered from the Indian Creek Site (Table 8). About one-half of the bifaces (N = 250) are indeterminate or general fragments and were not analyzed further. The remainder include six drills, 110 unfinished bifaces, and 202 projectile points (hafted bifaces). The latter group was subjected to typological analysis.

Sixteen point types were "identified" or "created" on the basis of shared attributes: overall size and shape, production and resharpening methods (flaking patterns), haft morphology, presence or absence of haft grinding, blade morphology, and presence or absence of blade serration. All of the hafted bifaces were laid out on tables, and like specimens were grouped together. After comparing and contrasting the attributes of each specimen, internally coherent groups or types had been created. A conservative approach to point typology was taken. If a specimen did not exhibit all or most of the attributes common to a particular type, it was considered untyped. The untyped specimens account for 31 percent of the hafted bifaces (N = 63). The 16 point types that were created were compared to previously established point types. The following reports and papers were most heavily relied upon: Broyles (1971), Coe (1964), Evans (1984), Funk (1988), Gleach (1987), Kinsey (1972), Ritchie (1971), and Stephenson and Ferguson (1963). During the comparison process, discussions with other LBA archaeologists about regional point types were extremely helpful; most noteworthy are the contributions of William Barse, Jonathan Lothrop, and R. Michael Stewart.

The 16 point types matched the following types: Palmer; Kirk corner-notched; Kirk stemmed; LeCroy; St. Albans; Kanawha; Stanly; Morrow Mountain II; Brewerton/Otter Creek; Vernon/Halifax; Savannah River, large variety; Savannah River, small variety; Holmes; Lackawaxen; Calvert; and Clagett (Table 9). Some of the Indian Creek point types fit more closely with existing point types than do others. These differences and similarities are outlined below, and descriptions of individual points are presented in Appendices G and H.

The lack of clear stratigraphy and radiocarbon dates at the Indian Creek Site made necessary the estimation of temporal ranges for the various point types from the regional literature. This fact, coupled with the condition of many of the points (i.e., damaged and/or heavily resharpened), made it clear that it would be prudent to combine related point types into point type clusters (e.g.,

TABLE 8. SUMMARY OF BIFACIAL TOOLS.

	ARTIFACT CATEGORY							
RAW MATERIAL	PROJECTILE POINT	DRILL	EARLY STAGE	MIDDLE STAGE	LATE STAGE	GENERAL	TOTAL	% OF TOTAL
QUARTZ	69	2	12	25	11	94	213	37.5
QUARTZITE	60	1	11	24	15	68	179	31.5
RHYOLITE	63	3	.	7	1	74	148	26.2
CHERT	3	.	.	.	.	7	10	1.8
CHALCEDONY	4	.	.	.	.	2	6	1.1
ARGILLITE	1	.	.	.	1	1	3	0.5
SANDY CHERT	1	.	1	.	.	2	4	0.7
JASPER	.	.	.	.	.	2	2	0.4
IRONSTONE	.	.	2	.	.	.	2	0.4
HEMATITE	1	.	.	.	.	.	1	0.2
TOTAL	202	6	26	56	28	250	568	100%

bifurcated base cluster). These factors also made it necessary to assume that the Indian Creek Site had been occupied by a series of separate groups or cultures who manufactured only one form or type of hafted biface, or a series of related forms (e.g., point type clusters). This assumption has become associated with the work of Coe (1964) and has been termed the "Coe Axiom" (Brennan 1967). In the Middle Atlantic, this assumption has come under attack for being too simplistic (e.g., Custer and Bachman 1986). Yet, this assumption is necessary at the Indian creek Site because the lack of stratigraphic separation provides no firm evidence of point type contemporaneity, that is, which point types should be considered contemporaneous. In fact, the raw material preferences between different point types are so striking that it is argued that the "Coe Axiom" may be a valid assumption, or at least an assumption worthy of additional testing in the Middle Atlantic region.

1. Palmer/Kirk Cluster (ca. 7800 - 6000 BC)

A total of 13 points are contained in this cluster: one is a typical Palmer point, two could be Palmer or Kirk corner-notched points, and the remainder are either Kirk corner-notched or Kirk stemmed (Plate 5). As mentioned above, clear typological distinctions are difficult to make with damaged and extensively resharpened and recycled specimens. Most of the points in this cluster have alternately beveled and serrated blades and varying degrees of haft grinding. The dominant raw material represented is rhyolite (Table 9); however, it is significant that, of the three hafted bifaces manufactured from chert in the entire assemblage, two are Palmer or Palmer/Kirk points. Metric data on the intact and nearly intact points are summarized in Table 10, and descriptions of each point are presented in Appendix G.

TABLE 9. SUMMARY OF PROJECTILE POINTS.

	RAW MATERIAL								
POINT TYPE	QUARTZ	QUARTZITE	RHYOLITE	CHALCEDONY	CHERT	SANDY CHERT	ARGILLITE	HEMATITE	TOTALS
PALMER	.	.	.	.	1	.	.	.	1
KIRK/PALMER	.	.	1	.	1	.	.	.	2
KIRK	2	1	7	.	.	.	.	.	10
ST. ALBANS	3	.	.	.	.	.	.	.	3
LeCROY	5	.	2	.	1	.	.	.	8
KANAWHA	3	.	6	.	.	.	.	.	9
STANLY	.	.	1	.	.	.	.	.	1
MORROW MOUNTAIN	.	1	1	.	.	1	.	.	3
BREWERTON/OTTER CREEK	3	3	5	.	.	.	.	.	11
VERNON/HALIFAX	33	3	1	.	.	.	1	.	38
CLAGETT	1	12	1	.	.	.	.	.	14
SAVANNAH RIVER, large	.	17	.	.	.	.	.	.	17
SAVANNAH RIVER, small	.	.	7	1	.	.	.	1	9
HOLMES	.	4	.	1	.	.	.	.	5
LACKAWAXEN	.	2	1	1	.	.	.	.	4
CALVERT	3	.	1	.	.	.	.	.	4
UNTYPED	16	17	29	1	.	.	.	.	63
TOTALS	69	60	63	4	3	1	1	1	202

2. <u>Bifurcated Base Cluster (ca. 7000 - 5300 BC)</u>

The bifurcated base cluster contains 21 hafted bifaces, which were assigned to four point types: St. Albans (N = 3), LeCroy (N = 8), Kanawha (N = 9), and Stanly (N = 1) (Table 9). These point types are closely related in morphology, technology, and temporal range (see Broyles 1971). To varying degrees, all Indian Creek points have bifurcated bases (or at least indented bases), haft grinding, and alternately beveled and serrated blades (Plates 6 and 7). Several of the Kanawha points could be described as having expanding stems with indented bases, rather than bifurcated bases. Two raw materials are nearly equal in popularity: quartz (N = 11) and rhyolite (N = 9). One point is manufactured from chert.

3. <u>Morrow Mountain II (ca. 4000 - 3000 BC)</u>

Three small contracting-stem points are tentatively classified as Morrow Mountain II points (Plate 7). Three different raw materials are represented: sandy chert, rhyolite, and quartzite. The sandy chert specimen--the only hafted biface in the assemblage manufactured from this material--is the one point that best fits the characteristics of the Morrow Mountain II point type. It is possible that the rhyolite specimen is actually a bifurcated-base point that sustained haft element damage and was reworked into a contracting stem. The quartzite specimen bears some resemblance to points of the Piscataway type.

4. <u>Brewerton/Otter Creek Cluster (ca. 4000 - 2300 BC)</u>

The 11 hafted bifaces assigned to this cluster are all side notched with straight to concave bases. Haft element grinding is common, as is bifacial resharpening (versus alternate beveling). Three raw materials are nearly equal in representation, with rhyolite (N = 5) the most common, followed by quartzite (N = 3) and quartz (N = 3). The rhyolite specimens display more extensive resharpening and recycling than do their quartz and quartzite counterparts (Plate 8). Two of the rhyolite points were recycled into hafted tools, a scraper and a chisel. The following point types were tentatively assigned to the hafted bifaces in this cluster: Brewerton side-notched, Brewerton eared-notched, and Otter Creek. After much debate and discussion, most of these points are believed to be Otter Creek points rather than Brewerton points. Resharpening and reworking of blades, as well as of haft elements, are evident in most specimens, supporting the conclusion that all or most of the points were once larger and more deeply side-notched.

5. <u>Vernon/Halifax (ca. 3500 - 2300 BC)</u>

With a total of 38 hafted bifaces, this point type is the most common in the assemblage (Table 9). All of the points match the range in variability that is evident in the published descriptions and illustrations of Vernon and Halifax points (i.e., Coe 1964; Stephenson and Ferguson 1963). Vernon points appear to be more variable in morphology than do Halifax points, but this variability may simply be a factor of sample size (e.g., Gleach 1987:Plate 9). Given their morphological similarities and apparent temporal overlap, these two point types are here considered the same point type and are referred to as Vernon points. The Vernon points in the assemblage can best be described as short, relatively thick, narrow bifaces with expanding stems (Table 10). Prior to resharpening, Vernon points were somewhat wider, particularly at the shoulders. Haft elements on some specimens could be described as side-notched or corner-notched (Plate 9). As with Vernon and Halifax points recovered from other sites (see Coe 1986; Gleach 1987; Stephenson et al. 1963), quartz was the preferred raw material at the Indian Creek Site (N = 33). The other raw materials represented include quartzite (N = 3), rhyolite (N = 1), and argillite (N = 1).

TABLE 10. SUMMARY OF PROJECTILE POINT MEASUREMENTS.

POINT TYPE		LENGTH	WIDTH	THICKNESS
Palmer (N=1)				
	Mean	36.0	23.0	7.0
Kirk/Palmer (N=2)				
	Mean	46.5	20.5	8.0
	Range	46.0 - 47.0	15.0 - 26.0	8.0
	St. Dev.	0.7	7.8	0.0
Kirk (N=7)				
	Mean	38.3	24.1	7.6
	Range	30.0 - 50.0	20.0 - 30.0	6.0 - 8.0
	St. Dev.	8.1	3.9	0.8
St. Albans (N=2)				
	Mean	37.0	23.0	10.0
	Range	29.0 - 45.0	20.0 - 26.0	8.0 - 12.0
	St. Dev.	11.3	4.2	2.8
LeCroy (N=4)				
	Mean	38.8	23.5	6.3
	Range	350 - 43.0	20.0 - 26.0	4.0 - 8.0
	St. Dev.	3.9	2.6	1.7
Kanawha (N=5)				
	Mean	37.4	23.2	8.6
	Range	33.0 - 42.0	20.0 - 27.0	6.0 - 10.0
	St. Dev.	3.6	2.6	1.7
Stanly (N=1)				
	Mean	33.0	24.0	7.0
Morrow Mountain II (N=2)				
	Mean	30.5	20.5	7.0
	Range	30.0 - 30.0	20.0 - 21.0	6.0 - 8.0
	St. Dev.	0.7	0.7	1.4
Brewerton/Otter Creek (N=9)				
	Mean	41.0	23.2	8.6
	Range	28.0 - 48.0	19.0 - 30.0	6.0 - 10.0
	St. Dev.	6.5	3.3	1.6
Vernon/Halifax (N=29)				
	Mean	3.48	19.9	8.1
	Range	25.0 - 47.0	17.0 - 24.0	6.0 - 10.0
	St. Dev.	5.1	1.8	0.8
Clagett (N=7)				
	Mean	51.1	21.4	8.9
	Range	38.0 - 65.0	20.0 - 22.0	7.0 - 11.0
	St. Dev.	10.4	0.8	1.3
Savannah River (N=6)				
	Mean	57.8	24.8	10.5
	Range	44.0 - 71.0	22.0 - 29.0	8.0 - 12.0
	St. Dev.	9.1	3.3	1.8
Holmes (N=5)				
	Mean	69.0	24.4	8.8
	Range	61.0 - 76.0	23.0 - 25.0	7.0 - 10.0
	St. Dev.	7.0	0.9	1.3
Lackawaxen (N=4)				
	Mean	58.5	18.8	9.3
	Range	46.0 - 84.0	15.0 - 23.0	8.0 - 11.0
	St. Dev.	17.3	3.3	1.5
Savannah River, small var. (N=5)				
	Mean	42.2	26.2	7.8
	Range	35.0 - 50.0	20.0 - 33.0	7.0 - 9.0
	St. Dev.	7.0	4.8	0.8
Calvert (N=4)				
	Mean	38.8	21.0	8.8
	Range	33.0 - 43.0	18.0 - 27.0	8.0 - 9.0
	St. Dev.	4.2	4.1	0.5

Note: measurements expressed in millimeters.

6. Clagett (ca. 3000 - 2000 BC)

The 14 hafted bifaces assigned to this point type are long, narrow, relatively thick, side-notched points with straight bases (Table 10). The notches are rather broad and sloping; as a result, haft elements could be described as having expanding stems rather than side notches (Plate 10). Haft elements are heavily ground, and blade edges are parallel to triangular. The latter configuration increases with resharpening. The widest point on most specimens is the base, but the shoulders are wider on those that appear to have been less frequently resharpened. The Clagett points from the Indian Creek Site are closely comparable to the type description of Clagett points (Stephenson et al. 1963:142-143), but they are less comparable to the Clagett points that were illustrated with the original type description (Stephenson et al. 1963:Plate 24). Despite the comparison of Clagett points to Bare Island and Orient Fishtail point types (Stephenson et al. 1963:177), the Clagett points from the Indian Creek Site share few attributes with these point types. The best match that could be found in the literature is with those points that Gleach (1987) has grouped together under the heading Halifax variant. Following his lead, the Clagett points from the Indian Creek Site are believed to be temporally if not stylistically related to Halifax and Vernon points. In fact, Clagett points and Gleach's Halifax variant points may be large quartzite versions of Vernon and Halifax points, which are typically made from quartz. Gleach (1987:97) reports that his Halifax variant points are commonly manufactured from quartzite, and all but two of the Clagett points from the Indian Creek Site are manufactured from quartzite (Table 9). Morphological and technological similarities also exist between the Indian Creek Clagett points and the Brewerton/Otter Creek point type cluster. The Indian Creek Clagett points appear to represent a real point type (however, see Wanser 1982:96), but their position in the regional chronology will have to await their discovery in a dated context. The temporal range suggested here is merely speculation, but general morphological and technological trends tie this point more closely to the Vernon/Halifax and Brewerton/Otter Creek point types than to any others.

7. Savannah River, Large (ca. 2500 - 1500 BC)

Seventeen hafted bifaces were recovered from the Indian Creek Site that are directly comparable to large Savannah River points. They are large, thick, broad points with straight stems and concave bases (Plate 11). Every specimen is manufactured from quartzite, and the full life cycle of this point type is represented--from production failures to extensively resharpened (exhausted) points. The latter specimens might be considered small Savannah River points by some researchers, but these points are clearly heavily reworked points and not a distinct type of smaller point (see also Gleach 1987:Plate 19).

8. Savannah River, Small (ca. 2000 - 1000 BC)

Nine hafted bifaces are tentatively classified as small-variety Savannah River points (Plate 12). The most distinctive characteristics of these points are their small size, short triangular blades, and straight stems, which are often unfinished (not flaked) or truncated (intentionally snapped). The majority of these points are manufactured from rhyolite (N = 7); chalcedony and hematite are represented by one point each. While it is debatable whether these points are truly small Savannah River points, it is noteworthy that they do resemble Gypsy points, which postdate small Savannah River points (Oliver 1985). At any rate, it is clear that there is no technological or morphological continuity between the large and small Savannah River points recovered from the Indian Creek Site.

9. Holmes (ca. 2500 - 1500 BC)

The five hafted bifaces assigned to this type are long and slender with short stems (Plate 13). The raw materials represented are quartzite (N = 4) and chalcedony (N = 1). Given that the Holmes point type has not been fully described in the literature, these points are only tentatively placed under this type. In terms of technology and morphology, these five points are similar to large Savannah River points, although they are narrower and thinner. One point in particular could be considered a thin Savannah River point. The other points are somewhat comparable to Lackawaxen straight-stemmed and converging-stemmed points (Kinsey 1972:410).

10. Lackawaxen (ca. 2500 - 1500 BC)

Four hafted bifaces are tentatively classified as Lackawaxen points (Plate 14). The largest specimen is manufactured from chalcedony and is directly comparable to the expanded-stem variety of the Lackawaxen point type (Kinsey 1972:408). The other points are manufactured from quartzite and rhyolite and are smaller in size.

11. Calvert (ca. 1200 - 1000 BC)

Four points are tentatively classified as Calvert points (Plate 14). Three of the points are manufactured from quartz, one from rhyolite. The latter point has been extensively reworked. One of the quartz points is rather narrow and bears some resemblance to points of the Bare Island type (Ritchie 1971).

12. Untyped

About half of the untyped hafted bifaces are so badly damaged or reworked or both that any attempt at typology would be sheer speculation. The remaining specimens are in somewhat better condition, but they do not readily fit into the above point types. Some of the points are similar to existing types, but they remain unassigned because they do not share enough attributes with the points in these types. Tentative typological assessments of these points are included in Appendix G, and selected specimens are shown in Plate 15. Worthy of note are two small triangular points that could be Late Archaic or Late Woodland; the former is suggested because of the absence of pottery at the site. Five rhyolite points, with either side notches or expanded stems, form a loose grouping of similar points (Plate 15). They bear some similarity to Normanskill points, as well as expanded-stem Lackawaxen points and Egypt Mills points (Kinsey 1972). Lastly, two small side-notched points are of interest because they resemble bifurcate-based points in size and technology (Plate 15).

13. Discussion

As Figure 26 illustrates, the typological analysis of the hafted bifaces indicates that the Indian Creek Site was more intensively occupied during certain portions of the Archaic period, and less intensively occupied during others. If the typological assessments of the hafted bifaces are reasonably accurate, as they appear to be, the site was continuously and rather intensively occupied during the early part of the Archaic (circa 7800 - 5300 BC). Groups who manufactured Palmer/Kirk points were apparently the first people to use the location in such a manner that resulted in the discard and abandonment of hafted bifaces. Directly following the Palmer/Kirk occupation, or perhaps somewhat overlapping it, was the use of the site by those groups who manufactured bifurcate-based points. Together, these two occupations represent a fairly continuous and intensive use of the Indian Creek Site. From information obtained from stratified sites (see Broyles 1971; Coe 1964; Gardner 1974), it can be inferred that the Palmer and Kirk corner-notched points represent the earliest occupation, followed by Kirk stemmed, St. Albans, LeCroy, Kanawha, and Stanly points, respectively. This occupational sequence started out being less intense, as represented by one or two Palmer points, and ended in the same fashion, represented by one Stanly point. In between these extremes, occupational intensity (as inferred from the number of hafted bifaces) peaked with the Kirk, LeCroy, and Kanawha points, with each point type represented by 8 to 10 points.

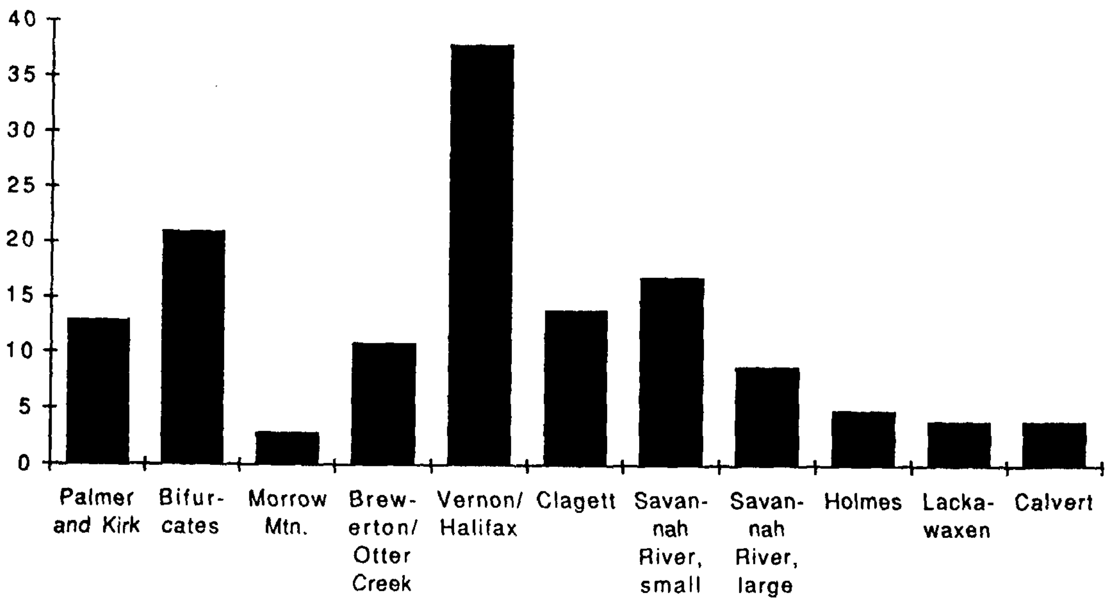


FIGURE 26: Frequency of Major Point Types

The next period of intensive site use was during the later part of the Archaic (ca. 4000 - 1500). Excluding the untyped hafted bifaces, the Late Archaic points account for well over half of all the points. As with the Early Archaic occupation of the site, the Late Archaic occupation appears to be fairly continuous. The most intensive occupations (in hypothesized chronological order) begin with those groups who manufactured Brewerton/Otter Creek points (N = 11), followed by those groups who manufactured Vernon/Halifax points (N = 38), Clagett points (N = 14), and large Savannah River points (N = 17). Temporal overlap between some of these point types, or with some of the less well represented types, is a real possibility. The broad time ranges assigned to these point types do not help the situation, but shorter time ranges are no more meaningful, unless they are based upon acceptable radiocarbon dates.

The apparent abandonment or ephemeral use of the Indian Creek Site between roughly 6000 and 4000 BC is interesting because it correlates with what some researchers consider the Middle Archaic. The duration of this "hiatus" is uncertain. Given the temporal ranges assigned to the various point types, the following scenario is suggested: (1) sometime after 6000 BC the site was rarely visited--the single Stanly point in the assemblage was probably deposited at the site during this time; (2) from 5000 to 4000 BC, the site was unused or used so briefly that no hafted bifaces were left behind; and (3) at about 4000 BC the site was used by two groups, those who manufactured Morrow Mountain points and those who manufactured Otter Creek points. The latter occupation was more intensive, but the date range for Otter Creek points is currently under debate (see Ebright 1989; Funk 1988; George and Davis 1986). Without firm dates and concise temporal ranges, a number of equally plausible scenarios can be suggested.

Whether or not one accepts the exact temporal placement of the various point types is unimportant because the point types, at a general level, document a repetitive cycle of land use: intensive utilization during the Early Archaic (i.e., Palmer/Kirk and bifurcate-based point clusters), followed by little or no use during the Middle Archaic, followed by intensive use during the Late Archaic (i.e., Brewerton/Otter Creek, Vernon/Halifax, Clagett, and large Savannah River points), and followed by little or no use during the entire Woodland period.

Furthermore, it is argued that the Indian Creek point types represent discrete or specific technological systems of biface production and hafting. As Christenson (1986) points out, the size (weight) and shape of a biface not only affects hafting, but also affects the size and composition of its shaft and its means of propulsion. Similarly, Callahan (1979) discusses the different knapping properties of various raw materials and how a knapper must alter his or her methods to achieve the same desired result with different raw materials. These two technological aspects of hafted biface design are seen as direct support for the argument that only one or two basic forms of hafted bifaces were produced by a given "culture" at a given point in time. It is also argued that changes through time in the design of hafted bifaces (shape, size, and raw materials) represent particular technological responses to environmental constraints or conditions. That specific bifacial forms tend to be made from specific raw materials is significant. These morphological and raw material correlations are not coincidental but are temporally discrete cultural responses to varying economic, and perhaps social, conditions. This thesis appears to be upheld by the Indian Creek hafted bifaces.

E. LITHIC PROCUREMENT

Raw material analysis identified 21 different material types. Descriptions of each material type are contained in Section C.1 of this chapter, and the overall results of the analysis are summarized in Table 11. This section first discusses raw material availability, then lithic procurement strategies.

TABLE 11. SUMMARY OF LITHIC ASSEMBLAGE.

	ARTIFACT CATEGORY											
RAW MATERIAL	BIFACE	UNI-FACE	MODIFIED FLAKE	COBBLE TOOL	GROUND STONE	CORE	CHUNK	FLAKE	FIRE-CRACKED ROCK	UNMOD-IFIED STONE	TOTAL	% OF TOTAL
QUARTZ	213	8	25	3	.	188	519	13,807	3,685	.	18,448	30.9
QUARTZITE	179	4	36	25	.	22	72	12,100	4,039	.	16,477	27.6
IRONSTONE	2	.	.	.	.	.	1	35	15,972	.	16,010	26.8
RHYOLITE	148	1	10	.	.	6	22	6,102	.	.	6,289	10.5
SANDY CHERT	4	.	1	.	.	3	11	1,919	.	.	1,937	3.2
CHERT	10	5	2	.	.	8	9	119	.	.	153	0.3
CHALCEDONY	6	.	2	.	.	1	2	124	.	.	135	0.2
JASPER	2	.	.	.	.	.	2	73	.	.	77	0.1
ARGILLITE	3	.	.	.	.	.	1	33	.	.	37	0.1
SCHIST	.	.	.	2	1	.	.	.	22	.	25	*
GNEISS	.	.	.	.	.	.	.	.	16	.	16	*
SILTSTONE	.	.	.	.	.	.	.	.	13	.	13	*
GABBRO	.	.	.	.	.	.	.	.	11	.	11	*
SANDSTONE	.	.	.	11	.	.	.	.	.	.	11	*
GRANITE	.	.	.	.	.	.	.	.	10	.	10	*
SERPENTINE	.	.	.	.	4	.	.	.	.	.	4	*
STEATITE	.	.	.	.	2	.	.	.	2	.	4	*
BASALT	.	.	.	.	.	.	.	1	1	.	2	*
LIMINOTE	.	.	.	.	2	.	.	.	.	.	2	*
PETRIFIED WOOD	.	.	.	.	.	.	.	.	.	2	2	*
HEMATITE	1	.	.	.	.	.	.	.	.	.	1	*
TOTAL	568	18	76	41	9	228	639	34,313	23,770	2	59,665	100%

*: less than 0.1 percent.

1. Resource Availability

The Middle Atlantic region is one of diverse geological and biological resources that occur in linear zones from the highlands to the coast. These zones are bisected by major drainages, such as the Potomac and the Susquehanna, both of which terminate in rich estuaries. In Maryland, a wide assortment of igneous, metamorphic, and sedimentary rocks occurs to the north and west of the Fall Line (Figure 27). Below the Fall Line, these bedrock units are buried by massive sequences of fine sediments and gravels. A direct result of these conditions is the absence of bedrock lithic sources in the Coastal Plain. With the exception of scattered deposits of ironstone, redeposited cobbles are the only locally available raw materials.

The Indian Creek Site is situated directly adjacent to, and on top of, a Pleistocene terrace of the Wicomico Formation (Matthews 1933). Subsurface gravel deposits were found during Phase II and Phase III investigations at the site, and gravel bars are known to occur along the course of Indian Creek. It is likely that these gravel deposits are part of the Wicomico Formation and were one of the resources that attracted Archaic groups to this location.

To assess the quantity and quality of cobbles available in the immediate vicinity of the site, a brief survey of Indian Creek was conducted. In less than 30 minutes, 64 cobbles were collected by one individual from a single gravel bar. The strategy was simply to collect the largest cobbles available. These cobbles were undoubtedly eroded from the Wicomico Formation. Raw material quality was assessed by detaching one or more flakes from each cobble. Only two raw materials are represented in the sample: quartz (N = 27) and quartzite (N = 37). The quartzite cobbles are slightly larger: they range in weight from 427.2 to 27.7 grams, with a mean weight of 170.7 grams. Common colors are light gray and tan. The quartz cobbles range in weight from 368.8 to 21.7 grams, with a mean weight of 106.4 grams. White and light gray are common colors. Some of the quartzite cobbles exhibit a weaker structure and could be considered low-grade orthoquartzites. It is noteworthy that the materials contained in many of the cobbles are identical to quartz and quartzite tools and debris recovered from the site. However, none of the cobbles exceeds 12 centimeters in length, and many are coarse grained and/or contain internal cleavage planes. The best of the cobbles could be knapped into medium-sized bifaces (5 to 10 cm in length), while nearly any of the cobbles could be converted into flake tools or used in cooking or heating facilities.

Because the Indian Creek Site is located near the juncture of the Coastal Plain and the Piedmont, a greater array of lithic raw materials was potentially available to the prehistoric inhabitants of the site than would be the case if the site were located further into the Coastal Plain. Within a 10-kilometer radius, both unconsolidated sand and gravel formations and igneous and metamorphic bedrock formations were potentially available to Archaic populations (Matthews 1933; Vokes and Edwards 1974). The igneous and metamorphic bedrock materials include granite, gabbro, schist, gneiss, and quartzite. An even greater assortment of raw materials is contained within formations exposed further into the Piedmont. In Washington, D.C., about 10 kilometers southwest of the site, extensive quarries and workshops of both quartzite and steatite have been reported (Ebright 1987; Holmes 1897). Similar quarries and workshops are known to occur along the Fall Line in adjacent areas of Maryland (William Barse and Robert Wall, personal communication 1991). Quartzite is known to occur as large cobbles and boulders at these locations.

In sum, the immediate vicinity of the Indian Creek Site contains few lithic raw materials, with the exception of scattered ironstone deposits and small cobbles of quartz and quartzite. It is likely that these conditions were the same throughout the Archaic period. If larger pieces of raw material were desired, or if other raw materials were desired, the inhabitants would have had to have journey into the Piedmont and beyond.

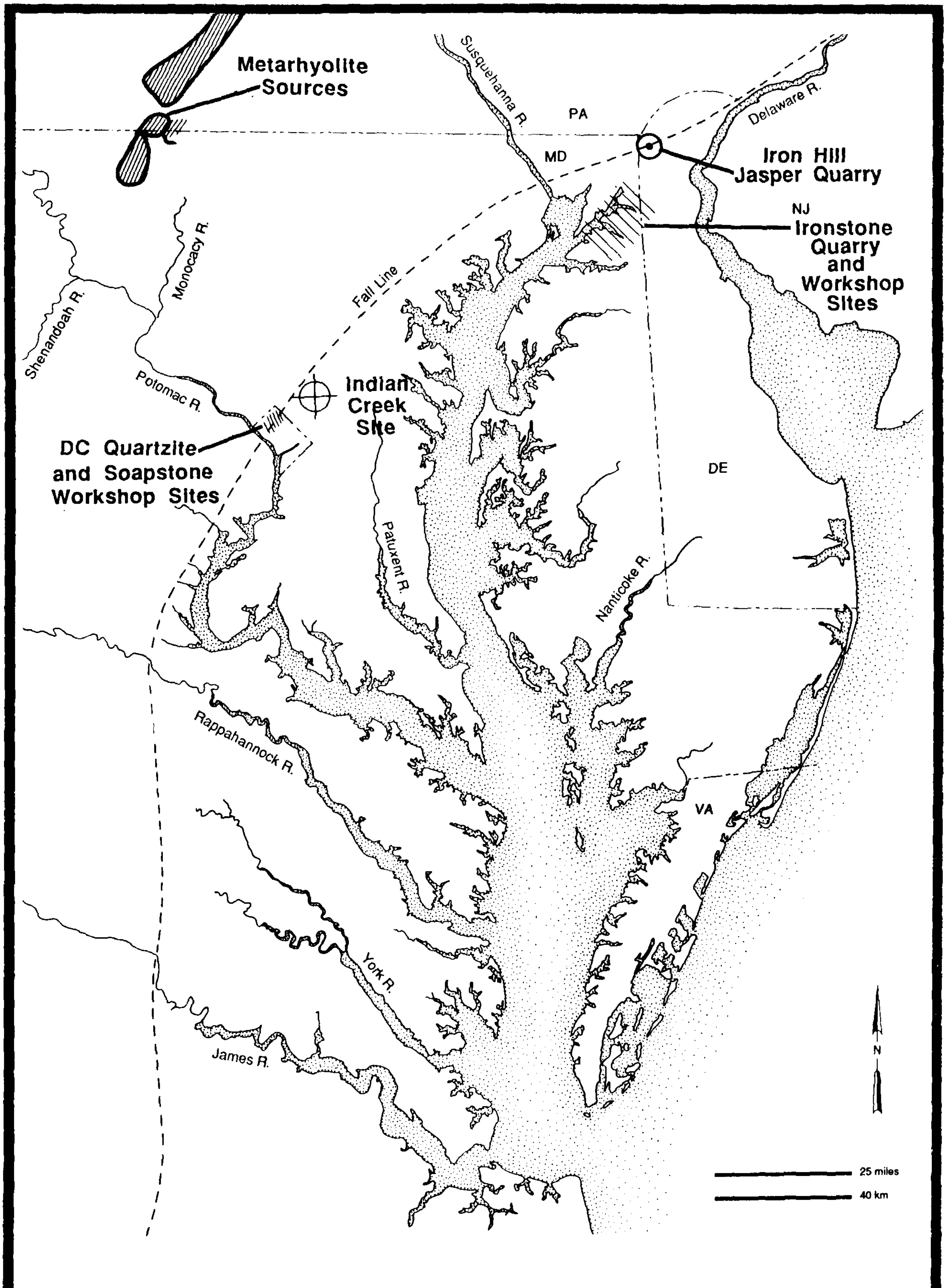


FIGURE 27: Regional Lithic Sources

2. Procurement Strategies

As Table 11 clearly illustrates, five raw materials make up 99 percent of the assemblage (by count): quartz (30.9%), quartzite (27.6%), ironstone (26.8%), rhyolite (10.5%), and sandy chert (3.2%). Quartz, quartzite, and ironstone are the three most common materials and are present in nearly equal proportions--18,448, 16,477, and 16,010, respectively. Considerably fewer pieces of rhyolite (N = 6,289) and sandy chert (N = 1,937) were recovered from the site. All of the remaining raw materials account for less than 1 percent of the assemblage. The dominance of quartz, quartzite, and ironstone can easily be explained by their local availability, particularly quartz and quartzite, for deposits of these materials are directly adjacent to the site. One significant difference between these materials is how they were used at the site. Quartz and quartzite were used in cooking/heating facilities (resulting in FCR) and were converted into a wide assortment of tools and resultant debris, while ironstone was seldom used for anything except components of cooking/heating facilities (Table 11).

Ironstone, in both count and weight, is the most common material represented in the FCR (N = 15,972 and Wt = 247.805 kg), followed by quartzite (N = 4,039 and Wt = 114.478 kg) and quartz (N = 3,685 and Wt. = 45,930 kg). The other materials represented in the FCR occur in small amounts (Table 12). Some of these materials may not be FCR but may actually be by-products of groundstone tool production. Most suspect are two fragments of steatite: one fragment is small and thin (1 g) and may have popped off of a steatite vessel; the other fragment is simply a tabular piece of steatite (212 g), which bears no evidence of modification. As noted above, the popularity of ironstone, quartzite, and quartz can be attributed to their immediate availability. Yet, it is interesting that, while quartz dominates the entire assemblage, ironstone and quartzite dominate the FCR. The selection of ironstone and quartzite over quartz is probably related to the more grainy structure of these materials--that is, ironstone and quartzite are less likely to fracture as violently (i.e., explode) as quartz and other fine-grained isotropic materials when subjected to thermal stress.

Taken as a whole, the chipped-stone assemblage is dominated by four raw materials (Table 13): quartz (41.2%), quartzite (34.6%), rhyolite (17.5%), and sandy chert (5.4%). The popularity of rhyolite (metarhyolite) is somewhat unexpected because it is not locally available. As discussed earlier, the likely source of this material is the South Mountain area of northern Maryland and southern Pennsylvania (Figure 27). The exploitation of rhyolite by the inhabitants of the Indian Creek Site could be the result of several different procurement strategies: (1) indirect procurement (i.e., exchange networks); (2) direct procurement, perhaps linked to seasonal movements between the highlands and the Coastal Plain (i.e., embedded procurement); or (3) direct procurement from redeposited sources (e.g., rhyolite cobbles in Coastal Plain stream and river gravels).

TABLE 12. SUMMARY OF FIRE-CRACKED ROCK.

RAW MATERIAL	TOTAL WT. (kg)	FREQUENCY	MEAN WT. (kg)
IRONSTONE	247.805	15,972	0.016
QUARTZITE	114.478	4,039	0.028
QUARTZ	45.930	3,685	0.012
GRANITE	0.774	10	0.077
GNEISS	0.337	16	0.021
STEATITE	0.213	2	0.107
SCHIST	0.207	22	0.009
GABBRO	0.136	11	0.012
SILTSTONE	0.062	13	0.005
BASALT	0.004	1	0.004
TOTAL	409.946	23,771	0.017

TABLE 13. SUMMARY OF CHIPPED-STONE ASSEMBLAGE.

RAW MATERIAL	ARTIFACT CATEGORY BIFACE	UNI-FACE	MODIFIED FLAKE	CORE	CHUNK	FLAKE	TOTAL	% OF TOTAL
QUARTZ	213	8	25	188	519	13,807	14,760	41.2
QUARTZITE	179	4	36	22	72	12,100	12,413	34.6
IRONSTONE	2	.	.	.	1	35	38	0.1
RHYOLITE	148	1	10	6	22	6,102	6,289	17.5
SANDY CHERT	4	.	1	3	11	1,919	1,938	5.4
CHERT	10	5	2	8	9	119	153	0.4
CHALCEDONY	6	.	2	1	2	124	135	0.4
JASPER	2	.	.	.	2	73	77	0.2
ARGILLITE	3	.	.	.	1	33	37	0.1
BASALT	.	.	.	.	.	1	1	*
HEMATITE	1	.	.	.	.	.	1	*
TOTAL	568	18	76	228	639	34,313	35,842	100%

*: less than 0.1 percent.

TABLE 14. FREQUENCY OF CORTEX IN THE ASSEMBLAGE.

RAW MATERIAL	ARTIFACT CATEGORY BIFACE	UNI-FACE	MODIFIED FLAKE	CORE	CHUNK	FLAKE	TOTAL	% OF TOTAL
QUARTZ	36	3	18	137	302	3,461	3,957	64.3
QUARTZITE	26	4	21	19	44	1,939	2,053	33.3
IRONSTONE	2	.	.	.	1	1	4	0.1
RHYOLITE	2	.	1	.	3	37	43	0.7
SANDY CHERT	1	.	1	1	7	28	38	0.6
CHERT	.	3	1	4	9	16	33	0.5
CHALCEDONY	.	.	2	1	2	9	14	0.2
JASPER	.	.	.	.	.	14	14	0.2
TOTAL	67	10	44	162	368	5,505	6,156	100%

The redeposition hypothesis can be rejected with some confidence, because rhyolite is not known to occur in any quantity in Coastal Plain gravel deposits, nor do the redeposited cobbles appear to be of adequate size or quality to be fashioned into chipped-stone tools (Stewart 1984b:4). The limited occurrence of cortex on rhyolite artifacts further supports this conclusion (Table 14); as does the nature of the cortex--that is, "cobble cortex" is not represented among the rhyolite artifacts with cortex. Rather, the cortex that is present can be described as "block cortex" or "primary cortex." In other words, the cortex is directly comparable to that which commonly occurs on rhyolite materials at the South Mountain source area (R. Michael Stewart, personal communication 1990). Obviously, rhyolite artifacts were arriving at the Indian Creek Site in finished or nearly finished form, with some artifacts retaining areas of block cortex.

The occurrence of cortex is summarized by raw material type in Figure 28. Again, the prevalence of quartz and quartzite is a result of their local availability. The minimal presence of rhyolite is a result of its nonlocal origin; however, similar conclusions cannot be drawn for all raw materials with low percentages of cortex. Ironstone is known to occur locally, and the limited number of artifacts with cortex is attributed to sample bias. The low percentage of sandy chert artifacts with cortex indicates that this material may be nonlocal, but the character of the cortex does not support this interpretation. Every specimen exhibits cobble cortex; hence, sandy chert appears to be a redeposited material that may have been locally available. Yet, sandy chert was not represented in the cobble sample collected from Indian Creek. This observation indicates that sandy chert may not be available in the immediate vicinity of the site or that it is a minor component of local cobble deposits. The same conclusions are directly applicable to the chert and chalcedony artifacts because cortex is not common, but when it is present, it is cobble cortex. The cortex present on

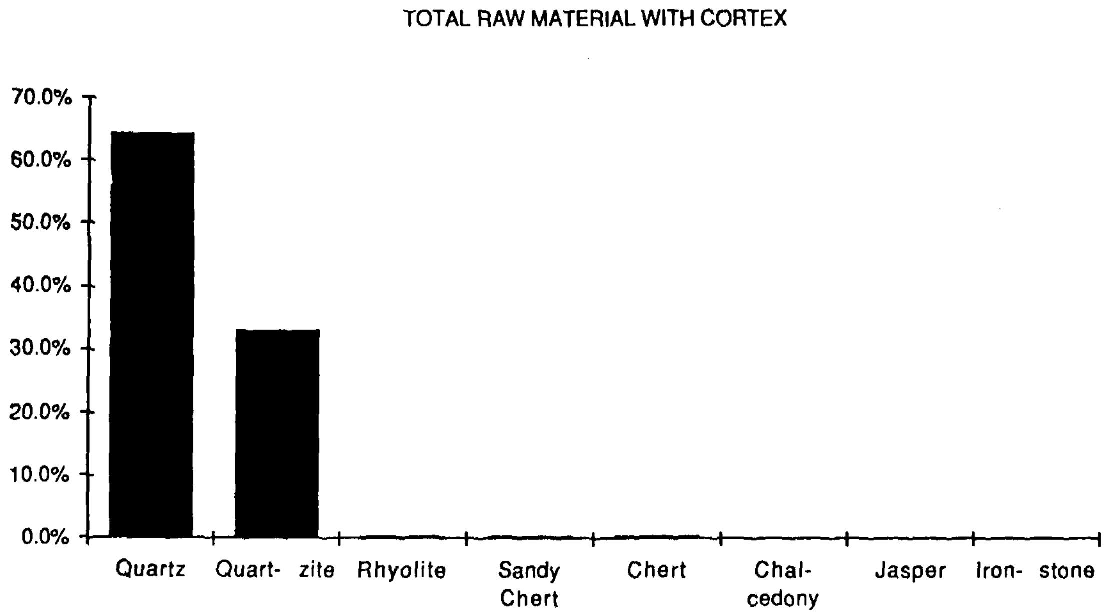


FIGURE 28: Frequency of Cortex by Raw Material Types

jasper artifacts is consistently block cortex, thus indicating a nonlocal source for this material. No cortex was observed on argillite artifacts, and although cortex is often difficult to identify on argillite artifacts, it is likely that the argillite artifacts in the assemblage were arriving at the site in finished form from a distant source.

In general, it can be concluded that only three of the raw materials used in chipped-stone tool production were not available or potentially available in the Coastal Plain: rhyolite, jasper, and argillite. The number of artifacts manufactured from argillite and jasper (particularly temporally diagnostic artifacts) is small, and thus provides little data with which to evaluate procurement strategies. Rhyolite, on the other hand, was an important resource, and its procurement is examined within a temporal framework by using hafted biface data.

In the Early Archaic, rhyolite was the dominant raw material, particularly among bifaces of the Palmer/Kirk cluster (Figure 29). The use of chert in biface production is restricted to this time period as well. The use of rhyolite for biface production continued into the Late Archaic, but its importance was greatly reduced (Figure 30). Notable exceptions are its strong representation among Brewerton/Otter Creek and small Savannah River points. Through time there is a pattern of increasing reliance upon locally available materials--quartz and quartzite--at the expense of rhyolite. This pattern corresponds nicely with traditional interpretations of the Late Archaic as a period of reduced settlement mobility and more restricted group territories. Consequently, the Early Archaic can be seen as a period of greater mobility, with seasonal rounds apparently including the South Mountain area and the Coastal Plain. If these interpretations are valid, it can be argued that the various inhabitants of the Indian Creek Site tended to select one or two raw materials from their environment for the manufacture of hafted bifaces. This "focused procurement" is seen as evidence of temporally discrete systems of biface production and hafting, which represent specific technological responses to environmental constraints.

F. LITHIC INDUSTRIES AND SITE ACTIVITIES

The lithic assemblage from the Indian Creek Site can be divided into two general industries, a chipped-stone and a groundstone industry. Within the chipped-stone industry, three separate, more specific industries can be identified: a biface industry, a formal flake-tool industry, and an informal flake-tool industry.

The biface industry is the most common; it is represented by 202 hafted bifaces, 110 unfinished bifaces, 6 drills, and 250 indeterminate biface fragments (Table 8). The hafted bifaces have been discussed in detail. The unfinished bifaces are believed to be hafted bifaces that were not completed because they were either rejected for some reason (e.g., breakage or severe hinge fractures) or the production process was halted so they could be stored (cached) and completed at a later date. One clear example of the caching of unfinished bifaces, Feature 29, was discovered during excavation. The bifaces from that feature are illustrated in Plate 16. During analysis, unfinished bifaces were roughly sorted into three stages according to their degree of completion. Early-stage bifaces are cobbles or large flakes that have had several flakes removed from two faces; cortex is common on one or both faces; and edges tend to be sinuous and irregular. Middle-stage bifaces look more like bifaces because they have been initially thinned and shaped; a lenticular cross section is developing, but edges are still somewhat sinuous, and patches of cortex may still remain. Late-stage bifaces are basically finished bifaces; they are well thinned, symmetrical in outline and cross section, and edges are centered, but they have no obvious haft modifications. It is apparent that some bifaces in all stages of production were either used to perform other tasks (e.g., cutting and chopping) after rejection (i.e., recycling) or they were manufactured specifically for these tasks and do not represent unfinished hafted bifaces. For this analysis, it is assumed that all early-, middle-, and late-stage bifaces are unfinished hafted bifaces.

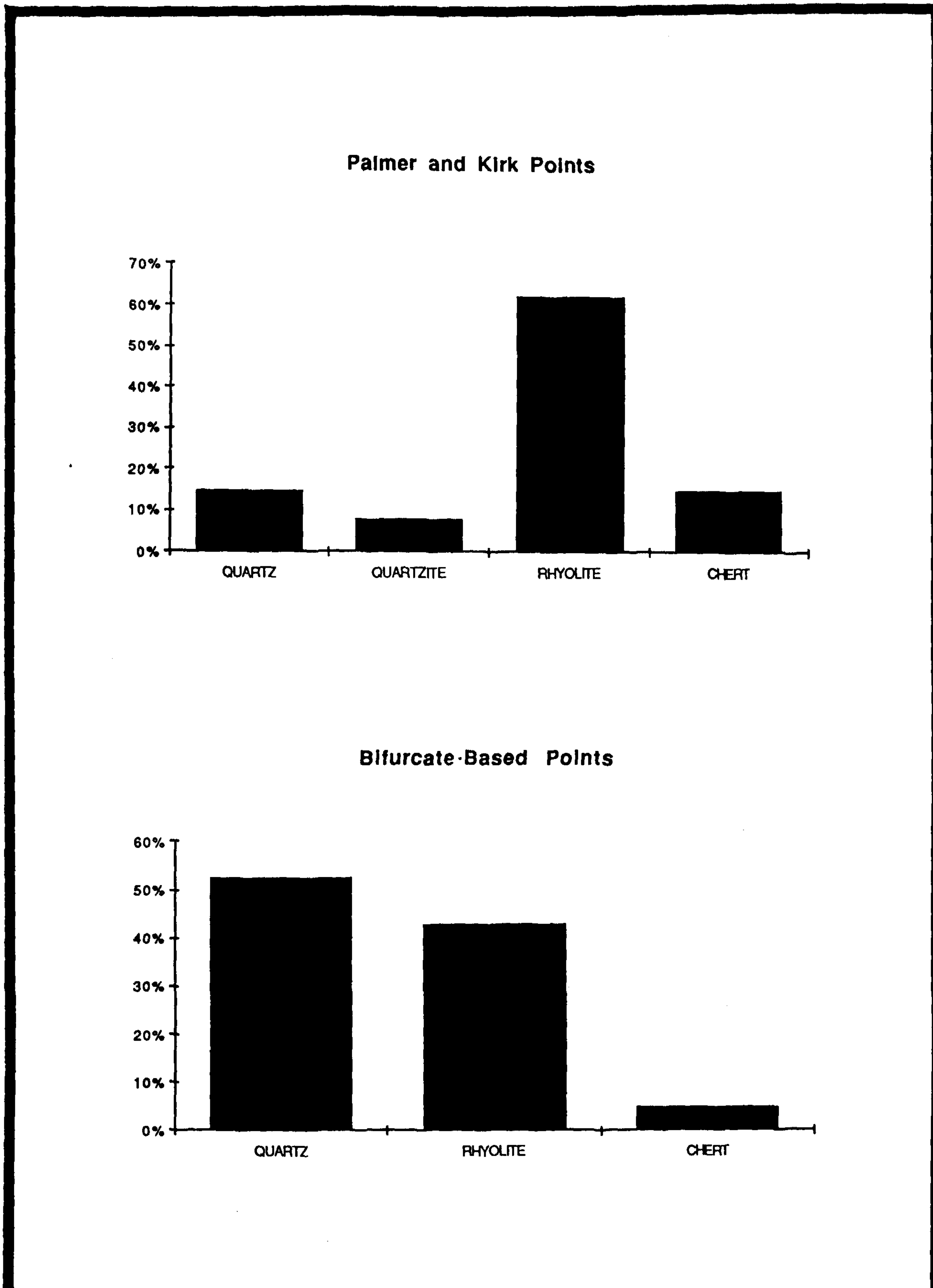


FIGURE 29: Frequency of Raw Material Types Among Early Archaic Point Types

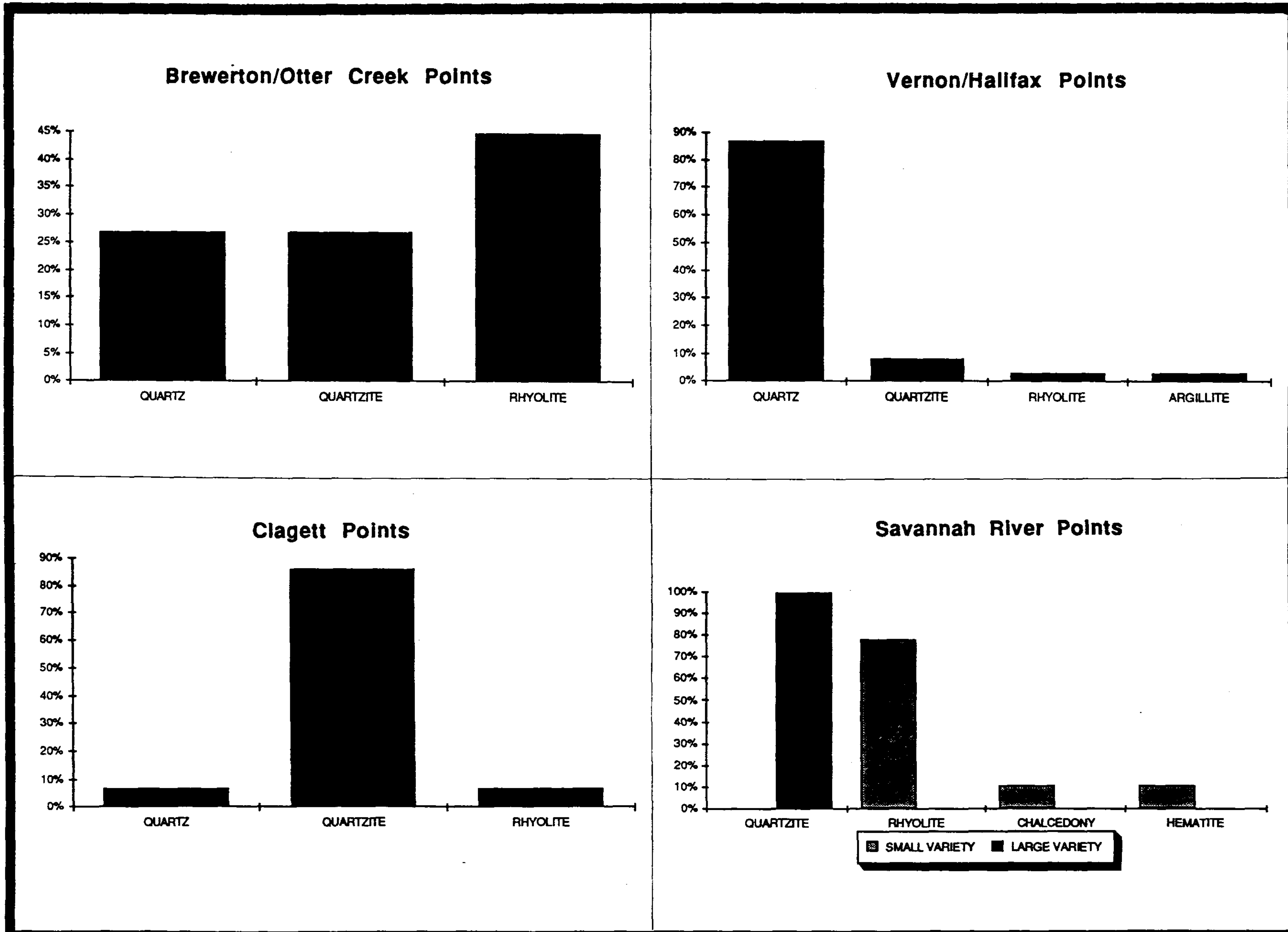


FIGURE 30: Frequency of Raw Material Types Among Late Archaic Point Types

This said, it is no surprise that very few (8%; N = 9) of the unfinished bifaces are not manufactured from locally available raw materials: 8 rhyolite and 1 argillite. The local materials include quartz (N = 48), quartzite (N = 50), ironstone (N = 2), and sandy chert (N = 1). Clearly, biface production at the site was primarily based upon locally available materials. Unfinished rhyolite bifaces were arriving at the site, but apparently in nearly finished form: 7 middle-stage bifaces and 1 late-stage biface. Therefore, it can be concluded that both finished and partly finished rhyolite hafted bifaces were transported to the Indian Creek Site. The latter were hafted biface preforms that may have also functioned as bifacial cores for flake tools. It is likely that these bifacial preforms/cores were carried to the site by Early Archaic groups. Examples of early-, middle-, and late-stage bifaces are illustrated in Plates 17, 18, and 19, respectively, and information about individual specimens is available in Appendix I.

The formal flake-tool industry is represented by 18 unifaces (Table 11). These artifacts are formalized scraping tools--endscrapers and sidescrapers, although they may have had multiple functions. They were probably hafted and designed to be reused. Most of these tools are manufactured from quartz (N = 8) and quartzite (N = 4), but one is made from rhyolite and five are made from chert. The chert specimens are probably Early Archaic because there is a definite preference for chert in the Early Archaic at the site, and the morphology of these specimens is typical of Early Archaic scrapers (Plate 20). The other specimens may be Early Archaic or Late Archaic. Apparently, tasks that required formalized flake tools were not widely conducted at the Indian Creek Site, unless many of the tools that were used were removed from the site. Specific details about individual artifacts are presented in Appendix J.

The informal flake-tool industry is represented by 76 expedient flake tools (modified flakes) and 228 cores. The flake tools are, for the most part, flakes that have been detached from cores and used as is for a variety of cutting and scraping tasks. Due to reasons already outlined in the methods section, the actual number of flakes that were used as tools is probably much higher. Quartz (N = 25) and quartzite (N = 36) are the most common raw materials, followed by rhyolite (N = 10), sandy chert (N = 1), chert (N = 2), and chalcedony (N = 2). Several of the rhyolite tools are clearly flakes that were detached from bifaces.

Three types of cores were identified (Table 15): tested cobbles, polymorphic cores (Plate 21), and bipolar cores (Plate 22). Tested cobbles may or may not be related to flake-tool production. They are merely cobbles that have had one to three flakes removed to inspect the suitability of the cobble for chipped-stone tool production, and for some reason, they were not further reduced. In certain cases, it is obvious that the cobbles were unsuitable, and thus, discarded. Quartz (N = 11) and quartzite (N = 4) are the only raw materials represented.

Polymorphic (freehand) cores are cobbles that have had flakes detached in multiple directions by holding the core in one hand and striking it with a hammerstone held in the other (Crabtree 1972). Platforms were selected opportunistically and preparation of platforms appears to have been minimal. As Table 15 indicates, quartz and quartzite are the dominant raw materials, by count and weight, with mean weights of 59 grams and 178 grams, respectively. Six rhyolite specimens have a mean weight of only 29 grams, and most of them appear to be extensively reworked (recycled) bifaces (possibly unfinished bifaces).

Bipolar cores are cobbles or pebbles that have had flakes detached by direct hard-hammer percussion on an anvil: the core is placed on the anvil and struck vertically with a hammerstone (Crabtree 1972; Hayden 1980). Cores typically assume a tabular shape, exhibit heavy crushing and battering, and flake scars tend to be oriented down the long axis of the core. Quartz accounts for 88 percent of the bipolar cores (N = 98), with a mean weight of 14 grams. The next most common material is chert, with seven specimens and a mean weight of only 2 grams (Table 15). Bipolar cores are normally smaller than polymorphic cores because bipolar reduction is a technique for maximizing available raw materials. Most flakes and shatter that are generated are suitable only

TABLE 15. SUMMARY OF CORES.

RAW MATERIAL	CORE TYPE TESTED COBBLE	POLYMORPHIC	BIPOLAR	TOTAL
QUARTZ				
Count	11	79	98	188
Total Weight	1,040	4,679	1,389	7,108
Mean Weight	95	59	14	38
QUARTZITE				
Count	4	15	3	22
Total Weight	529	2,677	34	3,240
Mean Weight	132	178	11	147
RHYOLITE				
Count	.	6	.	6
Total Weight	.	174	.	174
Mean Weight	.	29	.	29
CHERT				
Count	.	1	7	8
Total Weight	.	1	16	17
Mean Weight	.	1	2	2
SANDY CHERT				
Count	.	.	3	3
Total Weight	.	.	28	28
Mean Weight	.	.	9	9
CHALCEDONY				
Count	.	1	.	1
Total Weight	.	36	.	36
Mean Weight	.	36	.	36
TOTAL				
Count	1	102	111	228
Total Weight	1,569	7,657	1,467	10,603
Mean Weight	143	74	13	47

Note: all weights expressed in grams.

for expedient flake tools. It is possible that small flakes were hafted (see Flenniken 1981). It is also possible that some of the bipolar cores were used as wedges or chisels, but this does not appear to have been their main function (see Hayden 1980; Lothrop and Gramly 1982). At any rate, the production of simple flake tools is well represented in the assemblage, and their production was centered on quartz and quartzite cobbles. However, the popularity of quartz and chert in bipolar reduction is directly linked to their fine-grained isotropic structure, which permits small flakes to be detached that still exhibit clean, sharp, straight edges.

Flakes and chunks (angular shatter) are the only chipped-stone artifacts that have not yet been discussed because they cannot be assigned to any one industry. They are "general" by-products of chipped-stone tool production, and they constitute over half of the assemblage: 639 chunks and 34,313 flakes. It is clear that they are by-products of both biface reduction and flake-tool production, and it is noteworthy that most of the rhyolite flakes are biface-thinning and edge-maintenance flakes. Flake attributes (size and cortex) are summarized by raw material in Table 16. For quartz and quartzite, the complete biface reduction sequence appears to be represented, given the distribution of cortex and flake sizes shown in Table 16. The chunks are summarized in Table 17. The dominance of quartz and quartzite is not surprising, nor is the observation that a number of the rhyolite chunks appear to be blocky fragments of bifaces or unfinished bifaces. At least one crossmend (refit) supports this idea.

The groundstone industry can be divided into an informal groundstone industry and a formal groundstone industry. The informal groundstone industry encompasses the expedient use of local cobbles and ironstone for tools (N = 41 cobble tools) and stones for cooking/heating facilities (N = 23,771 FCR). The technology is simple. Locally available lithic materials were collected and used for various tasks, and then discarded or abandoned. The quartz and quartzite cobbles and ironstone blocks that are represented in the FCR were simply collected and used as is. The cobble tools in the assemblage are merely cobbles that were used to perform various tasks, with little or no prior modification, and then were discarded or abandoned. The tasks in which cobbles tools were employed are summarized in Table 18, and specific information about each specimen is presented in Appendix K. Examples of various cobble tools are illustrated in Plates 23, 24, and 25.

The formal groundstone industry is represented by nine fragmentary artifacts, and detailed information about each specimen is presented in Appendix M. Four specimens are tiny fragments of serpentine (or greenstone), and they all weigh one gram or less, have polished exteriors, and may have been detached from only 1 or two artifacts. What these artifacts were cannot be determined; they could have been bannerstones, pendants, or possibly axes. One or two steatite vessels are represented by two sherds (Plate 26), and pigment production appears to be represented at the site by two chunks of limonite with ground and striated surfaces. The remaining specimen appears to be an unfinished tool or ornament. It is a linear chunk of schist (or phyllite) that has been shaped by flaking, pecking, and grinding (Plate 26). However, it is just as likely that this specimen was roughly shaped by pecking and grinding so that it could function effectively as a wedge or chisel--one end is thin and has flakes removed, while the other end is thick and bears evidence of pounding and crushing. Except for this last artifact, there is no clear evidence of formal groundstone tool production at the site. Furthermore, the number of formal groundstone tools represented by these modest fragments is minimal. If tools like bannerstones and axes were used by the inhabitants of the site, they were not discarded or abandoned at the site in sufficient numbers to be recovered by the excavations.

To summarize, five discrete industries are represented in the lithic assemblage. The varying degrees to which they are represented furnish insights into the activities that were conducted at the site. The informal groundstone tool industry accounts for 40 percent of the assemblage because it represents an expedient technology--locally available lithic materials were collected, then used and discarded at the site. In contrast, the formal groundstone industry accounts for less than 1 percent of the assemblage because these tools were not manufactured at the site and because they are highly curated tools. That these tools were not manufactured or discarded (or abandoned) at the site is an indication that the Indian Creek Site probably never functioned as a base camp or major settlement.

The limited number of formalized flake tools, as well as informal flake tools, further supports this interpretation. In fact, if the chipped-stone "processing" tools--unifaces, modified flakes, and drills (N = 100)--and the hafted bifaces (N = 202) are expressed as a ratio (100/202 or 0.5:1), it is apparent that "processing" tasks are less well represented than those tasks that required hafted bifaces (Table 19). The same is true for the relationship between cobble tools or "plant

TABLE 16. SUMMARY LISTING OF FLAKES.

RAW MATERIAL		SIZE CATEGORIES (mm)												% OF
		<5	6-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100	TOTAL	TOTAL
QUARTZ														
	Total	501	2,907	8,012	1,721	490	130	33	11	2	.	.	13,807	40
	Cortex Present	43	470	1,870	719	242	86	22	8	1	.	.	3,461	10
QUARTZITE														
	Total	215	2,203	6,856	1,868	622	212	76	36	9	1	2	12,100	35
	Cortex Present	14	128	842	500	239	121	58	26	9	1	1	1,939	6
RHYOLITE														
	Total	442	1,888	3,316	340	82	27	7	.	.	.	.	6,102	18
	Cortex Present	.	10	14	5	3	3	2	.	.	.	.	37	0
SANDY CHERT														
	Total	.	247	1,305	285	65	15	1	.	1	.	.	1,919	6
	Cortex Present	.	.	15	8	3	2	.	.	.	.	.	28	0
CHALCEDONY														
	Total	.	20	82	18	4	.	.	.	.	.	.	124	0
	Cortex Present	.	2	3	2	2	.	.	.	.	.	.	9	0
CHERT														
	Total	5	44	58	10	2	.	.	.	.	.	.	119	0
	Cortex Present	.	1	9	5	1	.	.	.	.	.	.	16	0
JASPER														
	Total	14	19	35	5	.	.	.	.	.	.	.	73	0
	Cortex Present	1	2	7	4	.	.	.	.	.	.	.	14	0
IRONSTONE														0
	Total	.	14	17	4	.	.	.	.	.	.	.	35	0
	Cortex Present	.	.	1	.	.	.	.	.	.	.	.	1	0
ARGILLITE														
	Total	.	3	17	7	4	1	1	.	.	.	.	33	0
	Cortex Present	.	.	.	.	.	.	.	.	.	.	.	0	0
BASALT														
	Total	.	.	.	1	.	.	.	.	.	.	.	1	0
	Cortex Present	.	.	.	.	.	.	.	.	.	.	.	0	0
TOTAL														
	Total	1,177	7,345	19,698	4,259	1,269	385	118	47	12	1	2	34,313	100
	Cortex Present	58	613	2,761	1,243	489	212	82	34	10	1	1	5,504	16

NOTE: All flakes recovered during excavation and flotation included.

TABLE 17. SUMMARY LISTING OF ANGULAR SHATTER (CHUNKS).

	SIZE CATEGORIES (mm)										
RAW MATERIAL	<5	6-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	TOTAL
QUARTZ											
Count	4	47	191	144	87	36	8	2	.	.	519
Total Weight	5	64	376	728	1,106	919	387	123	.	.	3,708
Mean Weight	1	1	2	5	13	26	48	62	.	.	7
QUARTZITE											
Count	.	2	9	20	14	14	7	5	.	1	72
Total Weight	.	3	15	103	118	287	262	291	.	87	1,166
Mean Weight	.	2	2	5	8	20	37	58	.	87	16
RHYOLITE											
Count	.	.	8	5	4	5	.	.	.	.	22
Total Weight	.	.	14	22	31	78	.	.	.	.	145
Mean Weight	.	.	2	4	8	16	.	.	.	.	7
SANDY CHERT											
Count	.	.	2	4	3	.	1	.	1	.	11
Total Weight	.	.	3	20	31	.	32	.	39	.	125
Mean Weight	.	.	2	5	10	.	32	.	39	.	11
CHALCEDONY											
Count	.	.	.	1	1	.	.	.	.	.	2
Total Weight	.	.	.	3	12	.	.	.	.	.	15
Mean Weight	.	.	.	3	12	.	.	.	.	.	8
CHERT											
Count	.	.	5	1	3	.	.	.	.	.	9
Total Weight	.	.	15	2	11	.	.	.	.	.	28
Mean Weight	.	.	3	2	4	.	.	.	.	.	3
JASPER											
Count	.	1	.	.	.	.	.	.	.	.	1
Total Weight	.	1	.	.	.	.	.	.	.	.	1
Mean Weight	.	1	.	.	.	.	.	.	.	.	1
IRONSTONE											
Count	.	.	.	1	.	.	.	.	.	.	1
Total Weight	.	.	.	7	.	.	.	.	.	.	7
Mean Weight	.	.	.	7	.	.	.	.	.	.	7
ARGILLITE											
Count	.	.	.	.	1	.	.	.	.	.	1
Total Weight	.	.	.	.	8	.	.	.	.	.	8
Mean Weight	.	.	.	.	8	.	.	.	.	.	8
TOTAL											
Count	4	50	215	176	113	55	16	7	1	1	638
Total Weight	4	68	423	885	1,317	1,284	681	414	39	87	5,202
Mean Weight	1	1	2	5	12	23	43	59	39	87	8

Note: all weights expressed in grams.

TABLE 18. SUMMARY OF COBBLE TOOLS.

RAW MATERIAL	TOOL TYPES HAMMER-STONE	HAMMER-STONE/ MULTI-USE	PESTLE	MANO	METATE	ANVIL/ MULTI-USE	ABRA-DING STONE	TOTAL	% OF TOTAL
QUARTZ	3	.	.	.	.	.	.	3	7
QUARTZITE	13	5	1	2	2	1	1	25	61
SANDSTONE	9	2	.	.	.	.	.	11	27
SCHIST	.	.	2	.	.	.	.	2	5
TOTAL	25	7	3	2	2	1	1	41	100%

processing" tools and hafted bifaces (41/202 or 0.2:1). Even though cobble tools and informal flake tools represent expedient technologies, these tools make up a smaller segment of the assemblage than do the hafted bifaces. It should be noted that more than half of the cobble tools are hammerstones, which were probably used in lithic reduction activities. Clearly, the production and maintenance of chipped-stone tools, particularly bifaces, was an important activity to both the Early and Late Archaic occupants of the site. Yet, the ratio of unfinished bifaces to finished bifaces (110/202 or 0.5:1) indicates that the site was not strictly a lithic workshop (see Ericson and Purdy 1984). Apparently, an assortment of different tasks was undertaken, but lithic reduction was one of the most common. The large numbers of heavily resharpened and/or broken hafted bifaces indicate that much of the lithic reduction was geared toward refurbishing tool kits, specifically refitting projectiles with new points. These refurbishing tasks were apparently conducted in concert with exploitive and processing tasks, as represented by hafted bifaces, cobble tools, unifaces, modified flakes, and FCR. Neither the Early Archaic nor the Late Archaic occupations appear to have been of lengthy duration; rather, the lithic assemblage seems to indicate that the site was frequently reoccupied, but for short periods of time.

TABLE 19. SUMMARY OF ARTIFACT CLASS RATIOS.

ARTIFACT CATEGORIES	RAW COUNTS	RATIO
Early-Stage, Middle-Stage and Late-Stage Bifaces to Projectile Points	110/202	0.5:1
Cores to Projectile Points	228/202	1.1:1
Cores to Modified Flakes	228/76	3.0:1
Polymorphic Cores to Bipolar Cores	102/111	0.9:1
Unifacial Tools, Modified Flakes, and Drills to Projectile Points	100/202	0.5:1
Cobble Tools to Projectile Points	41/202	0.2:1
Hammerstones to Other Cobble Tools*	32/16	2.0:1

*Multiple-use tools counted on both sides of ratio.

G. RESIDUE ANALYSIS

Bone preservation at the Indian Creek Site was very poor. As a result, residue analysis was undertaken in the hope that subsistence information could be gleaned from the surfaces of stone tools. Two levels of residue analysis were conducted: simple presence/absence tests (Level I) and more sophisticated family-level tests (Level II). Both methods focused on blood residue, but the latter analysis also tested for fern residue. The results of the two levels of analysis are summarized below.

Before proceeding, however, it should be noted that residue analysis is a relatively new analytical tool employed by archaeologists, and its analytical value is not yet understood fully. While interesting and encouraging test results have been achieved, particularly with family- and species-level tests, there have been limited attempts at independent verification of test results. In addition, a number of questions, particularly about the effects of various site formation processes, have yet to be resolved to the satisfaction of many researchers.

As part of both the Level I and the Level II analyses, soil samples and naturally occurring pebbles were submitted for testing. These "control samples" all tested negative. Specimens were selected for residue analysis in the laboratory, and were not washed or labeled; however, they were inventoried and photocopied with a minimum of handling. Currently, none of the artifacts that were submitted for analysis have been washed, although dry brushing has been done. Specimens that tested negative in the Level I analysis have been labeled, but artifacts that tested positive have not been labeled.

1. Level I: Presence/Absence Testing

Level I testing of lithic artifacts was undertaken during Phase II and Phase III investigations. These tests were performed by the Archaeology Laboratory at the University of Delaware. The method used is simple; in brief, it entails creating a solution with distilled water and soil adhering to the surface of an artifact. This solution is tested for blood residue by using a commercially available chemstrip, which registers the presence of blood residue by changing colors (see Custer et al. 1988a, 1988b).

During the Phase II analysis, 34 specimens were tested, and 8 of the 34 (or 24%) were positive--that is, the presence of blood residue was detected. For the Phase III analysis, 512 specimens were tested, and 41 (or 8%) were positive. In both samples, the majority of specimens submitted were bifaces; therefore, it is no surprise that bifaces had the greatest number of positive test results. The results of the Phase III residue analysis are summarized in Table 20. Phase II results are discussed in more detail elsewhere (LeeDecker et al. 1988).

Unfortunately, only 7 of the Phase III bifaces (N = 25) that tested positive could be classified as hafted bifaces: 2 Vernon/Halifax points, 2 bifurcated-base points, 1 Holmes point, 1 small Savannah River point, and 1 indeterminate basal fragment (Plate 27). The other 18 bifaces are either "unfinished" hafted bifaces or distal portions of hafted bifaces. The remaining specimens represent an array of simple tool and debris. However, the test results indicate that thise "debris" may very well have been expedient tools--briefly used then discarded (Plates 28 and 29).

2. Level II: Family-Level Testing

PaleoResearch Laboratories in Golden, Colorado, performed the family-level blood residue and fern residue tests. The tests were conducted under the direction of Margaret Newman, and her report is contained in Appendix Q. A brief discussion of the methods employed are presented there and can also be found in more detail in Newman (1990a) and Newman and Julig (1989).

TABLE 20. SUMMARY OF BLOOD RESIDUE TESTING.

CAT. NO.	PROVENIENCE	ARTIFACT TYPE	PRESENCE/ ABSENCE*	FAMILY**
1116	EU 39, Strat B, Lvl 5, NW	biface	positive	bovine, human
1135	EU 46, Strat B, Lvl 3, SW	flake tool	positive	negative
1138	EU 47, Strat A, Lvl 1	biface	positive	bovine, chicken
1159	EU 48, Strat A, Lvl 1	flake	positive	fern
1170	EU 48, Strat B, Lvl 4, SE	unifacial tool	positive	bovine
1215	EU 51, Strat A, Lvl 1	core	positive	bovine
1215	EU 51, Strat A, Lvl 1	flake tool	positive	negative
1225	EU 51, Strat B, Lvl 5, NE	scraper	negative	negative
1274	EU 52, Strat B, Lvl 2, NW, Feature 7	flake tool	positive	bovine
1274	EU 52, Strat B, Lvl 2, NW, Feature 7	flake	positive	bovine
1295	EU 54, Strat B, Lvl 3, NW	flake	positive	negative
1361	EU 57, Strat A, Lvl 1	biface	positive	guinea pig
1379	EU 58, Strat A, Lvl 1	flake	positive	mouse, chicken
1382	EU 58, Strat B, Lvl 2, SE	biface	positive	trout
1484	EU 65, Strat A, Lvl 1	flake	positive	deer
1484	EU 65, Strat A, Lvl 1	hafted biface	positive	mouse, rat
1503	EU 63, Strat B, Lvl 3, NE	biface	positive	dog, fern
1531	EU 66, Strat A, Lvl 1	flake	positive	fern
1534	EU 66, Strat B, Lvl 2, SE	flake	positive	deer
1534	EU 66, Strat B, Lvl 2, SE	scraper	negative	negative
1586	EU 69, Strat B, Lvl 3, SE	scraper	negative	negative
1673	EU 76, Strat A, Lvl 1	hafted biface	positive	negative
1771	EU 85, Strat B, Lvl 3, NE	biface	positive	deer, bovine
1916	EU 99, Strat A, Lvl 1	flake tool	positive	dog, human, trout
1935	EU 92, Strat B, Lvl 2, NW	flake tool	positive	negative
2184	EU 113, Strat A, Lvl 1	biface	positive	deer, rabbit, mouse
2220	EU 89, Strat A, Lvl 1	biface	positive	deer, bear
2221	EU 89, Strat B, Lvl 2, NE	biface	positive	deer
2240	EU 112, Strat B, Lvl 2, NE	biface	positive	mouse, chicken
2252	EU 121, Strat A, Lvl 1	biface	positive	bovine, deer, rabbit, human
2286	EU 115, Strat B, Lvl 2, NW, Feature 19	biface	positive	deer
2287	EU 90, Strat A, Lvl 1	biface	positive	deer
2340	EU 124, Strat A, Lvl 1	biface	positive	mouse, fern
2581	EU 147, Strat A, Lvl 1	hafted biface	positive	deer, guinea pig
2591	EU 147, Strat B, Lvl 4, NW	hafted biface	positive	negative
2620	EU 151, Strat B, Lvl 3, NW	hafted biface	positive	negative
2707	EU 138, Strat B, Lvl 3, SW	hafted biface	positive	negative
2723	EU 156, Strat B, Lvl 3, NE	scraper	negative	negative
2734	EU 142, Strat A, Lvl 1	hafted biface	positive	mouse, rat
2779	EU 135, Strat B, Lvl 3, SW	cobble tool	positive	mouse, trout
2810	EU 137, Strat A, Lvl 1	biface	positive	NSR***
2902	EU 160, Strat B, Lvl 2, NE	biface	positive	bovine
2989	EU 146, Strat B, Lvl 2, SW	flake	negative	negative
3080	EU 144, Strat A, Lvl 1	biface	positive	negative
3103	EU 148, Strat B, Lvl 3, SW	biface	positive	negative

*: tests conducted by University of Delaware.
**: tests conducted by PaleoResearch Laboratories.
***Non-specific reaction (i.e., non-specific protein).

The 41 artifacts that tested positive for blood residue in the Level I analysis were submitted for family-level testing, in addition to four specimens that tested negative in the Level I analysis. These four tools (endscrapers and sidescrapers) were included for two reasons: (1) no obvious examples of formal scraper tools tested positive in the Level I analysis, yet it was thought that tools such as these would be likely candidates for harboring blood residue; and (2) they were considered a "control sample" that would provide data with which to elevate both the Level I and the Level II analyses. The Level II test results were negative, thus confirming the level I results (Table 20). Nevertheless, only 29 of the 41 artifacts that tested positive in the Level I analysis tested positive at the family-level. One explanation is that all of the residue that was present was used up in the Level I analysis. This is a valid concern, when a two-level residue analysis program is used (Margaret Newman, personal communication 1991). A curious result is the fact that two artifacts tested positive for blood residue in the Level I analysis, but in the Level II analysis, they only tested positive for fern residue (Catalog Numbers 1159 and 1531).

Twelve groupings or "families" were identified. They are listed below in order of popularity (i.e., number of positive tests). These "families" are based on immunological associations and do not necessarily have any direct relationship to the Linnaean classification scheme (see discussion in Appendix Q). The family names refer to the animal antisera that are prepared for use in forensic medicine and were employed in the analysis.

a. <u>Deer</u> (N =10): White-tailed Deer, Elk, Moose, and Caribou.
b. <u>Bison</u> (N = 9): American Bison or possibly Elk.
c. <u>Mouse</u> (N = 7): small New World rodents.
d. <u>Fern</u> (N = 4): nonspecific fern.
e. <u>Chicken</u> (N = 3): Turkey, Grouse, and Quail.
f. <u>Trout</u> (N = 3): Atlantic Salmon, Arctic Char, and Trout.
g. <u>Human</u> (N = 3): Native Americans or Euro-Americans.
h. <u>Dog</u> (N = 2): Domestic Dog, Wolf, Coyote, and Fox.
i. <u>Rat</u> (N = 2): large New World Rodents.
j. <u>Rabbit</u> (N = 2): specifically, Cottontail Rabbit.
k. <u>Guinea Pig</u> (N = 2): specifically, Porcupine, but possibly Beaver and Squirrel.
l. <u>Bear</u> (N = 1): probably Black Bear.

A problem with this analysis is its level of detail, which is directly linked to the antisera that are presently available. The relationship between the various rodent groups is not completely clear. Further research should produce greater clarity. Only three hafted bifaces produced positive results (Plate 27): one Vernon/Halifax (Mouse and Rat), one Holmes (Mouse and Rat), and one small Savannah River (Deer and Guinea Pig). Overall, the test results conform to accepted notions of Archaic subsistence--deer and elk (bison?) most intensively hunted, followed by various small game animals.

H. CONCLUSIONS

Excavation has provided a large number of lithic artifacts (N = 59,665) from the Indian Creek Site. The preceding pages have described the analytical methods that were used, the data that were generated, and the interpretations of the data that were made. The appendices contain detailed listings of the data. Specific research questions were posed, and interpretations made in subsequent sections have directly and indirectly answered the questions. Here the research questions are answered in a direct and succinct manner.

1. Technology and Function

a. In general, what was the range of activities performed at the site?

The Indian Creek Site appears to have been a short-term habitant site that was frequently reoccupied by Early and Late Archaic groups. Common activities performed included chipped-stone tool production and maintenance, and procurement and processing of foodstuffs. Hunting of large game, such as deer and elk, appears to have been a regular practice.

b. Specifically, what kinds of stone tools were manufactured, maintained, and recycled at the site, and what kinds of subsistence tasks or other activities appear to be represented?

As stated above, hunting is well represented in the assemblage. Processing of plant resources is indicated by an assortment of cobble tools and FCR clusters. Butchering and hide working are represented by various chipped-stone tools. But stone working is by far the best-represented activity: hafted bifaces were manufactured, maintained, and recycled; formal flake tools were manufactured and maintained; informal (expedient) flake tools were manufactured; informal (expedient) groundstone tools (cobble tools) were "manufactured"; and formal groundstone tools are poorly represented.

c. Does the range of activities change through time?

With the limited temporal data available, the general range of tasks does not appear to have changed; however, the site does appear to have been more intensively utilized during certain periods.

d. Are plant and/or animal residues preserved on the surfaces of the stone tools recovered from the site; if so, how do these residues match the functional classification of each tool, which is based upon morphology and use-wear?

Residues were detected, and it was somewhat unexpected to find plant and animal residues on seemingly unmodified pieces of debitage. These artifacts could represent expedient tools. However, they could merely be pieces of debitage, and other factors could be responsible for the presence of organic residues on their surfaces. Unintentional associations between artifacts and residues are possible through various site formation processes.

2. Style

a. What cultural components are represented at the site?

Both Early and Late Archaic groups inhabited the site. No clear evidence of Paleoindian, Middle Archaic, or Woodland groups was found.

b. How intensive were these occupations?

The most intensive occupations, as measured by point type frequencies, were by groups that manufactured hafted bifaces of the Palmer/Kirk cluster, bifurcated-base cluster, Brewerton/Otter Creek cluster, Vernon/Halifax type, Clagett type, and large Savannah River type. Of these, the Vernon/Halifax component was the most intensive.

3. Raw Material Selection

a. What raw materials were used in tool production?

A total of 21 different raw materials were identified; the four most common are quartz, quartzite, ironstone, and rhyolite.

b. Are raw material preferences apparent in the hafted bifaces; if so, do they change through time?

Raw material preferences are clearly represented in the hafted bifaces, and they do change through time. Rhyolite was primarily selected by Early Archaic groups, while quartz and quartzite were primarily selected by Late Archaic groups.

c. Which materials were locally available, and which materials were obtained from distant sources?

Quartz and quartzite are locally available, and rhyolite is a nonlocal material, available at a distance of approximately 100 kilometers.

d. Were materials from distant sources acquired via exchange networks, or were they procured as part of a broader settlement strategy?

It is likely that rhyolite was directly procured as part of an Early Archaic land-use pattern that entailed seasonal mobility. The use of rhyolite by the Brewerton/Otter Creek component may have followed a similar pattern.

In conclusion, it must be stressed that the preceding interpretations of the Indian Creek Site are biased--they represent the "lithic view" of the site. Stone tools were an important part of the overall technology and economy of the Archaic groups that "set up shop" at the site; yet, they only furnish certain kinds of information. With new techniques such as residue analysis, stone tools and debris may provide archaeologists with additional avenues with which to study the economies of extinct cultures.

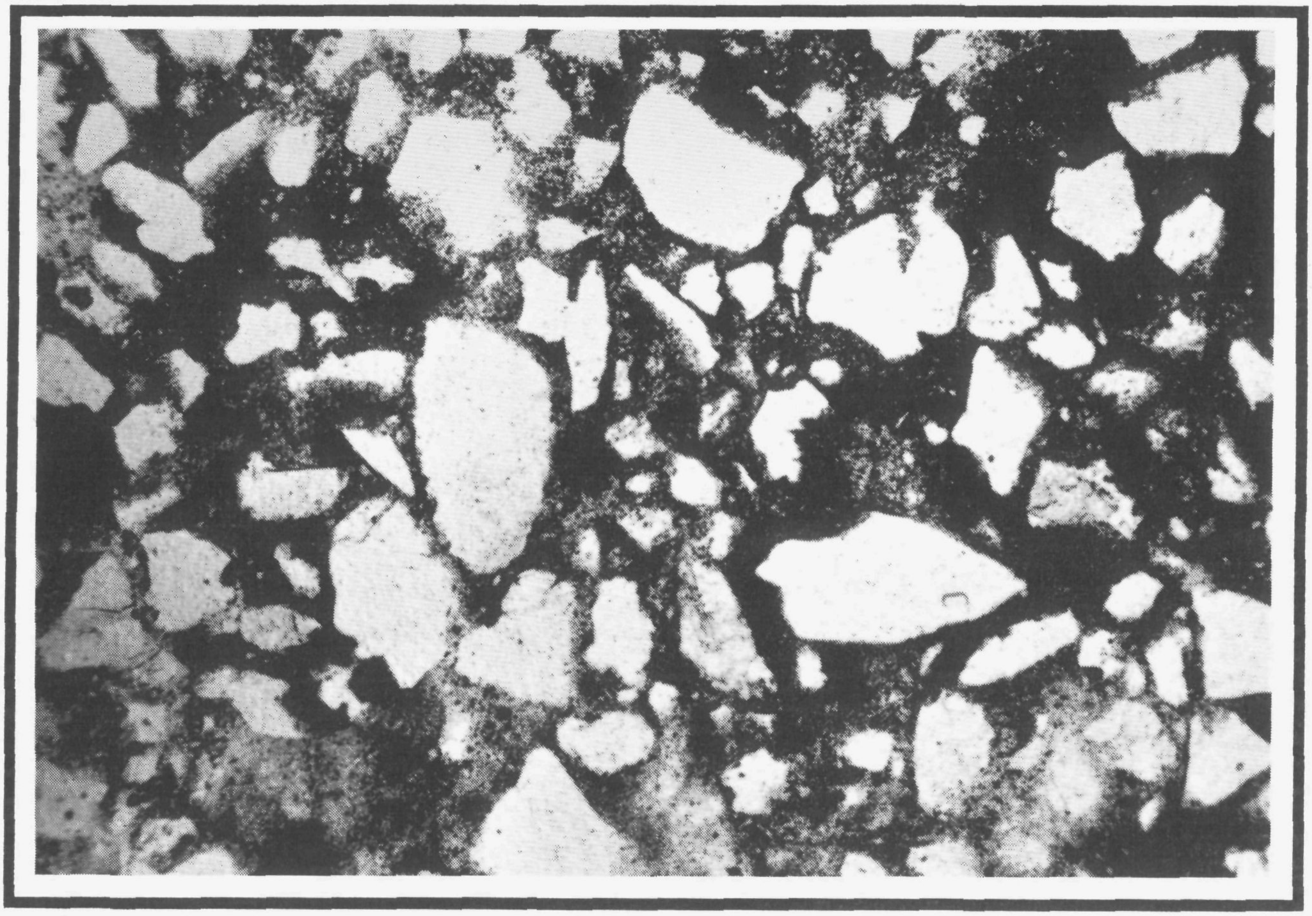


PLATE 4: Thin Section of Sandy Chert (enlargement of a 2x3 mm section of the slide)

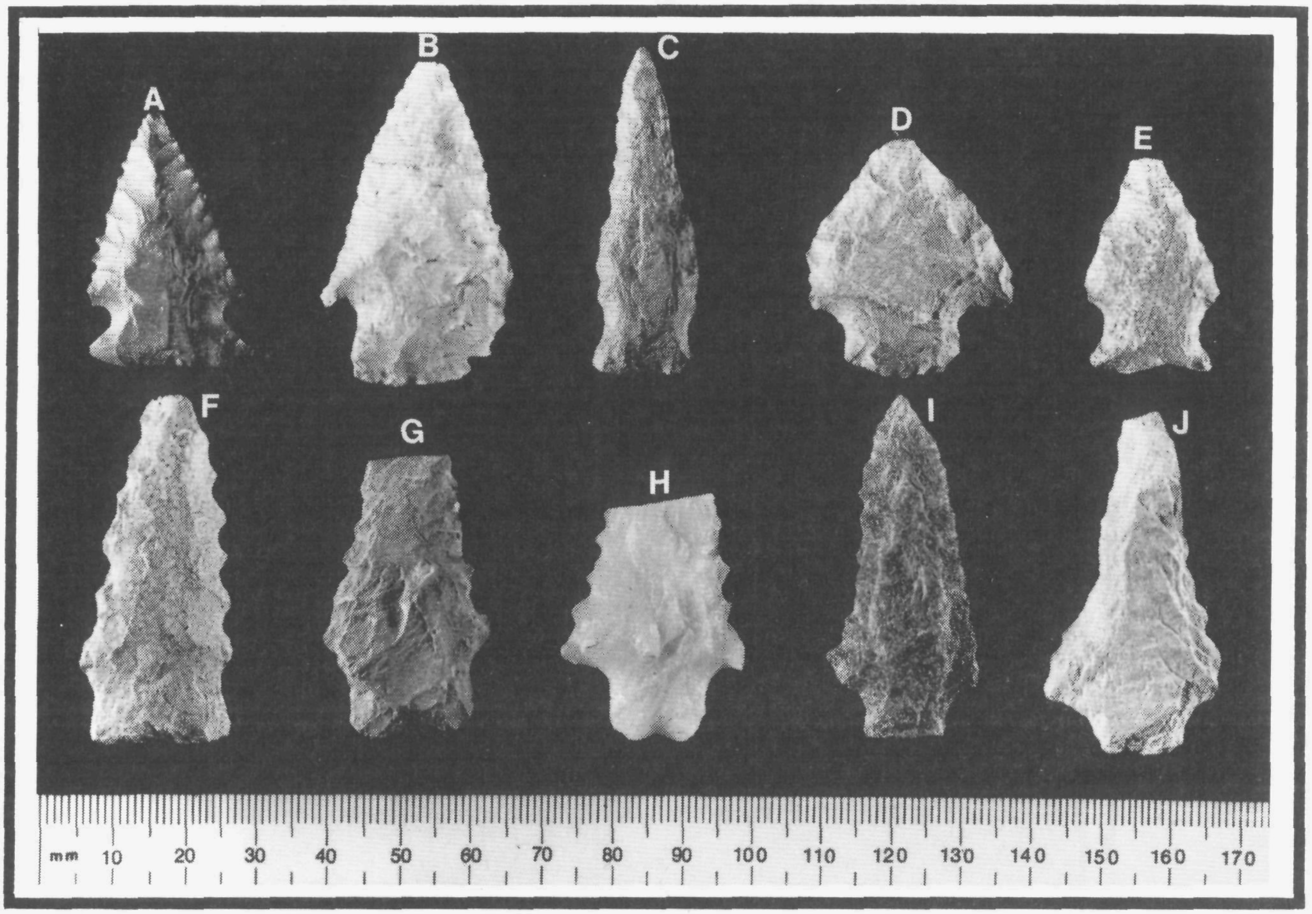


PLATE 5: Palmer/Kirk Points (circa 7800 - 6000 BC)

A Chert Palmer (Cat. # 2136)
B Chert Palmer/Kirk (Cat. # 2719)
C Rhyolite Palmer/Kirk (Cat. # 2220)
D Rhyolite Kirk Corner Notched (Cat. # 1364)
E Rhyolite Kirk Corner Notched (Cat. # 2262)
F Rhyolite Kirk Stemmed (Cat. # 1921)
G Rhyolite Kirk Stemmed (Cat. # 2224)
H Quartz Kirk Stemmed (Cat. # 2229)
I Quartzite Kirk Stemmed (Cat. # 2323)
J Rhyolite Kirk Stemmed (Cat. # 3088)

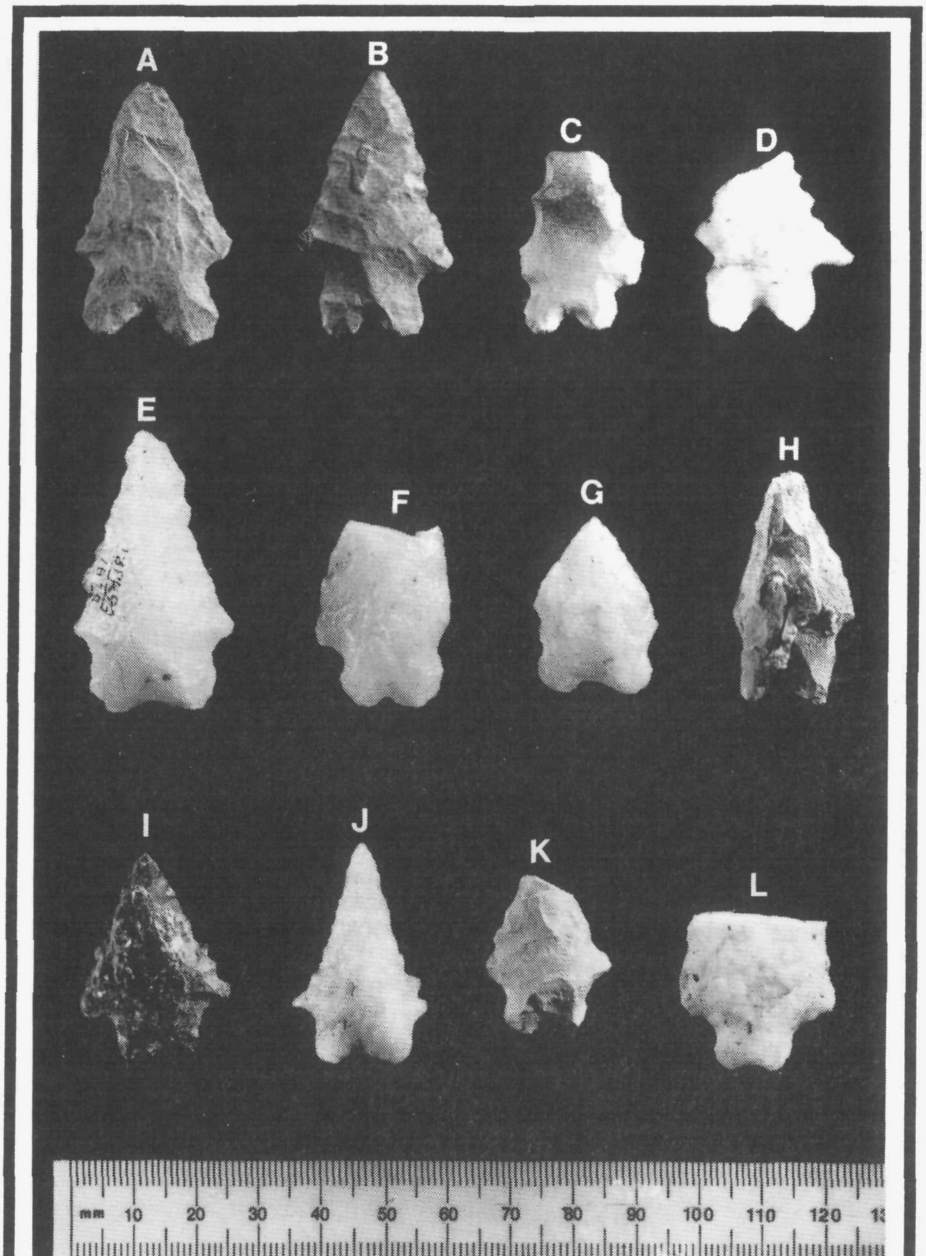


PLATE 6: Bifurcated-Base Points (circa 7000 - 5300 BC)

A Rhyolite LeCroy (Cat. # 1639)
B Rhyolite LeCroy (Cat. # 2269)
C Chert LeCroy (Cat. # 1202)
D Quartz LeCroy (Cat. # 2645)
E Quartz St. Albans (Cat. # 1628)
F Quartz St. Albans (Cat. # 2734)
G Quartz St. Albans (Cat. # 2177)
H Rhyolite Kanawha (Cat. # 1678)
I Rhyolite Kanawha (Cat. # 2291)
J Quartz Kanawha (Cat. # 2711)
K Rhyolite Kanawha (Cat. # 2925)
L Quartz Kanawha (Cat. # 2990)

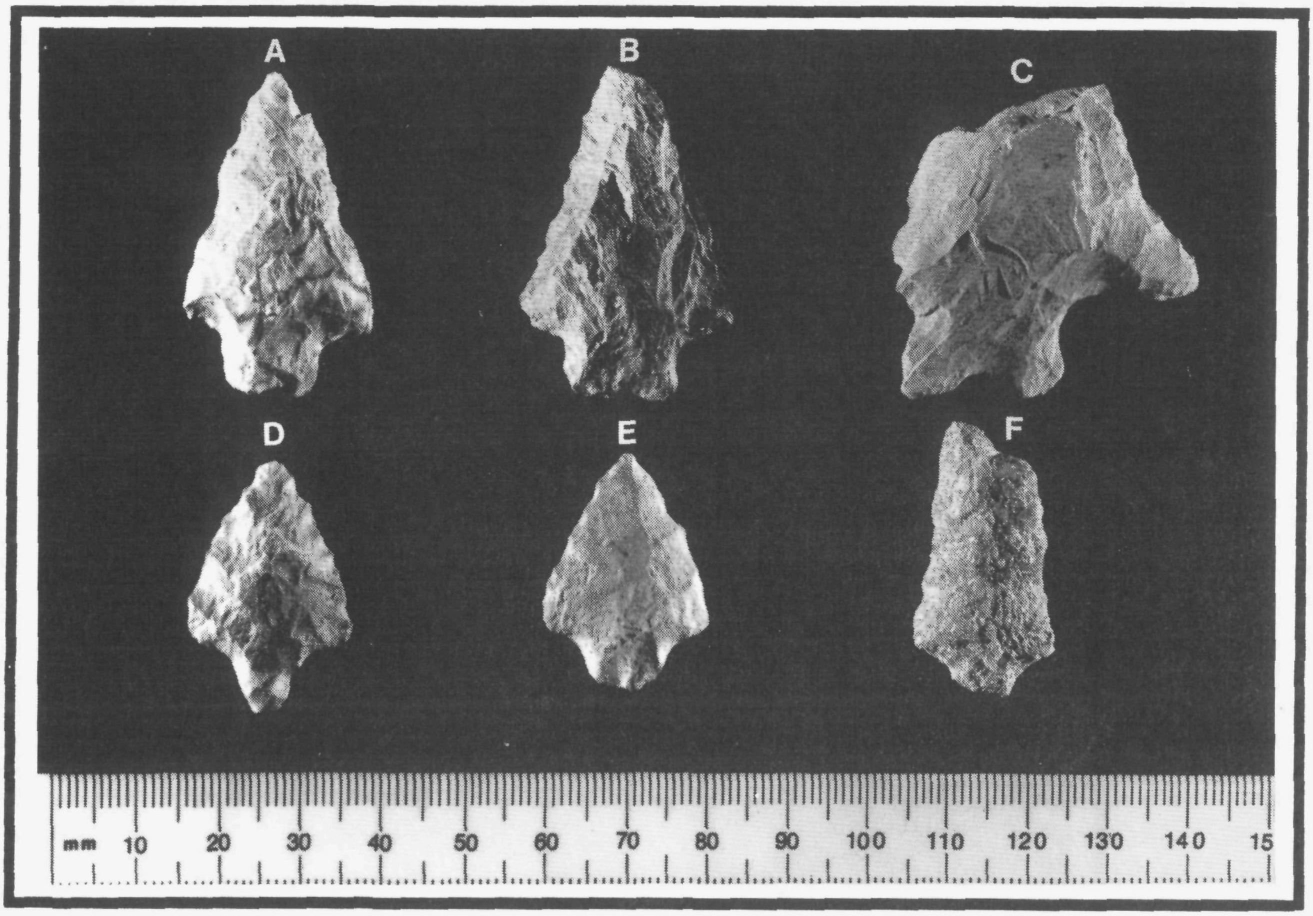


PLATE 7: Bifurcated-Base (circa 7000 - 5300 BC) and Morrow Mountain (circa 4000 - 3000 BC) Points

A Rhyolite Kanawha (Cat. # 2205)
B Rhyolite Kanawha (Cat. # 1767)
C Rhyolite Stanly (Cat. # 2828)
D Sandy Chert Morrow Mountain II (Cat. # 2707)
E Rhyolite Morrow Mountain II (?) (Cat. # 1237)
F Quartzite Morrow Mountain II (?) (Cat. # 1694)

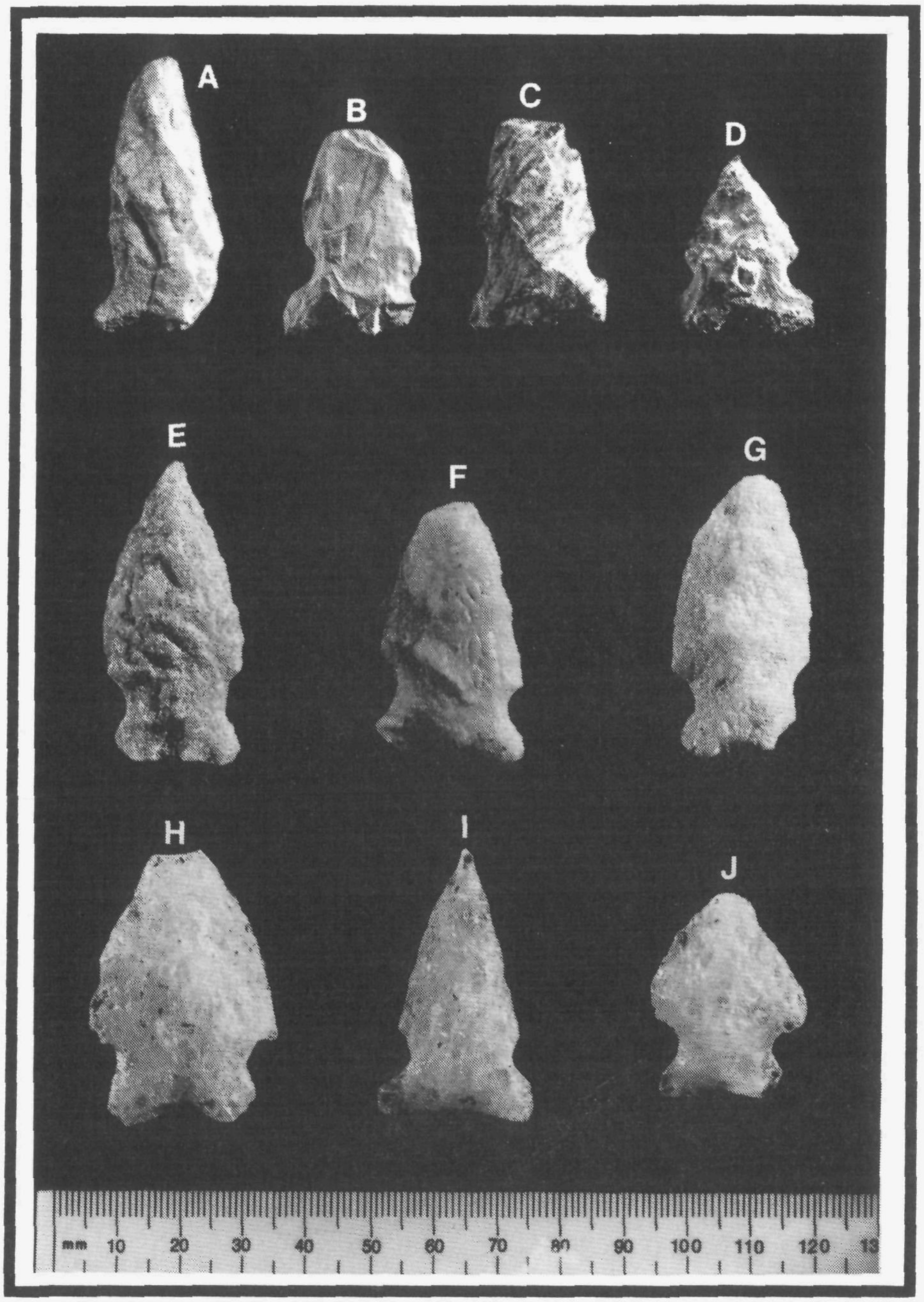


PLATE 8: Brewerton/Otter Creek Points (circa 4000 - 2300 BC)

A Rhyolite (Cat. # 1329)	F Quartzite (Cat. # 2848)
B Rhyolite (Cat. # 1327)	G Quartzite (Cat. # 2575)
C Rhyolite (Cat. # 1071)	H Quartz (Cat. # 1444)
D Rhyolite (Cat. # 1777)	I Quartz (Cat. # 2002)
E Quartzite (Cat. # 2647)	J Quartz (Cat. # 2310)

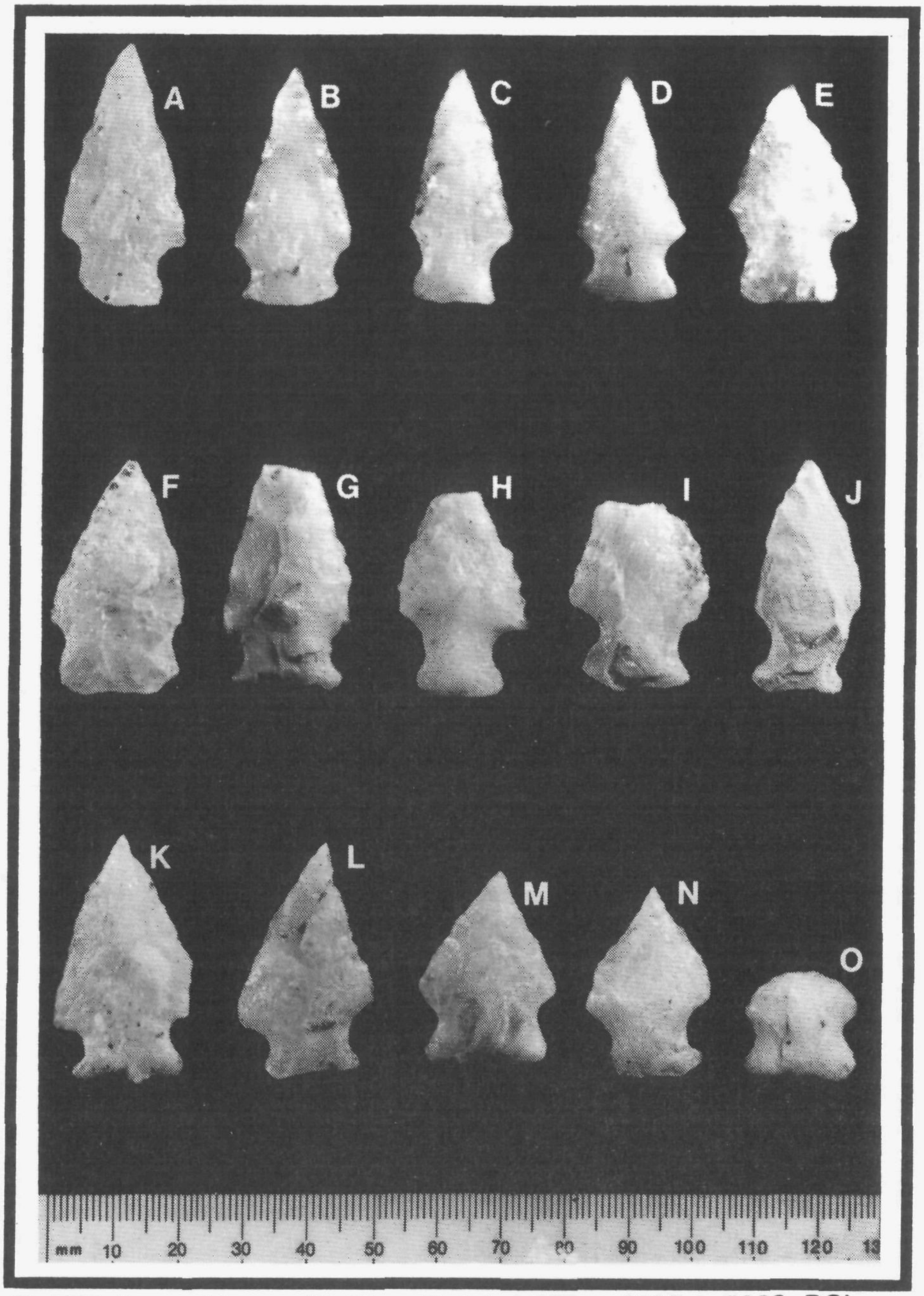


PLATE 9: Vernon/Halifax Points (circa 3500 - 2300 BC)

A Quartz (Cat. # 3082)
B Quartz (Cat. # 2752)
C Quartz (Cat. # 1179)
D Quartz (Cat. # 1484)
E Quartz (Cat. # 1006)
F Quartz (Cat. # 1425)
G Quartz (Cat. # 1159)
H Quartz (Cat. # 1196)
I Quartz (Cat. # 1179)
J Argillite (Cat. # 1538)
K Quartz (Cat. # 2565)
L Quartz (Cat. # 2703)
M Quartz (Cat. # 2877)
N Quartz (Cat. # 2790)
O Quartz (Cat. # 1781)

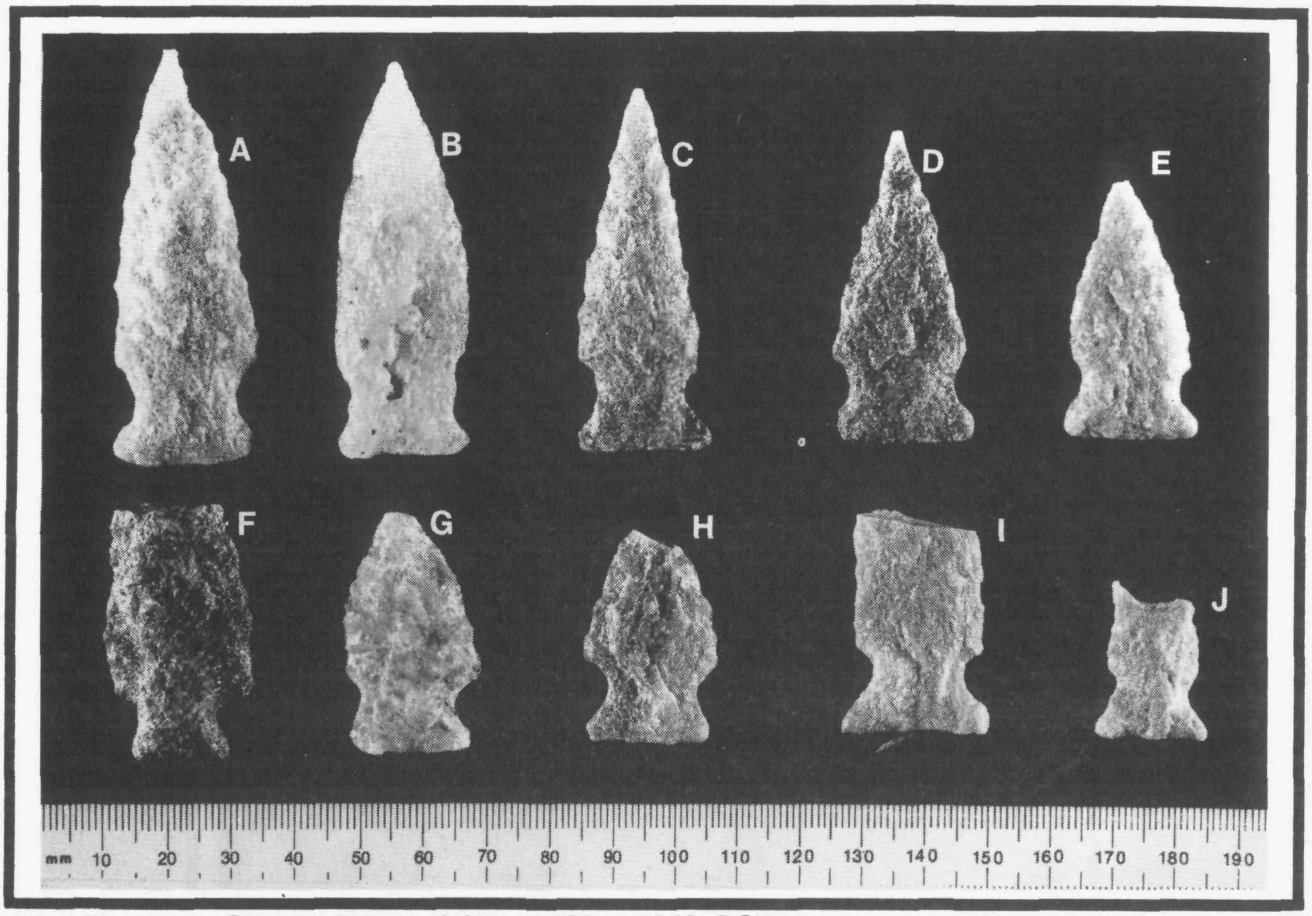


PLATE 10: Clagett Points (circa 3000 - 2000 BC)

A	Quartzite (Cat. # 2566)
B	Quartzite (Cat. # 2940)
C	Quartzite (Cat. # 2152)
D	Quartzite (Cat. # 2585)
E	Quartzite (Cat. # 2724)
F	Quartzite (Cat. # 1429)
G	Quartz (Cat. # 1636)
H	Quartzite (Cat. # 1981)
I	Quartzite (Cat. # 1875)
J	Quartzite (Cat. # 2960)

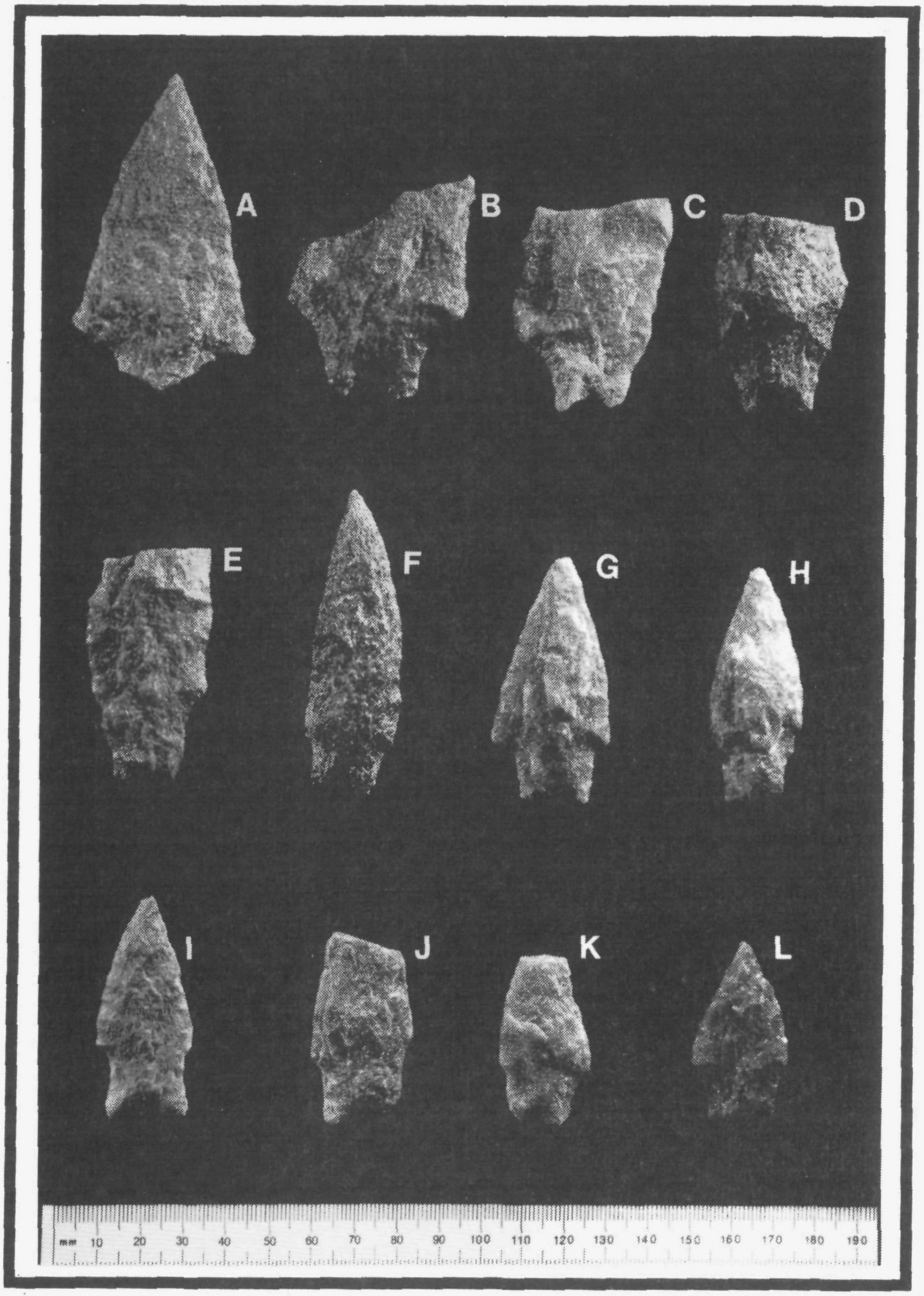


PLATE 11: Large Savannah River Points (circa 2500 - 1500 BC)

A	Quartzite (Cat. # 1512)	G	Quartzite (Cat. # 2019)
B	Quartzite (Cat. # 1512)	H	Quartzite (Cat. # 1704)
C	Quartzite (Cat. # 1365)	I	Quartzite (Cat. # 1881)
D	Quartzite (Cat. # 2699)	J	Quartzite (Cat. # 2093)
E	Quartzite (Cat. # 2581)	K	Quartzite (Cat. # 3049)
F	Quartzite (Cat. # 2662)	L	Quartzite (Cat. # 1498)

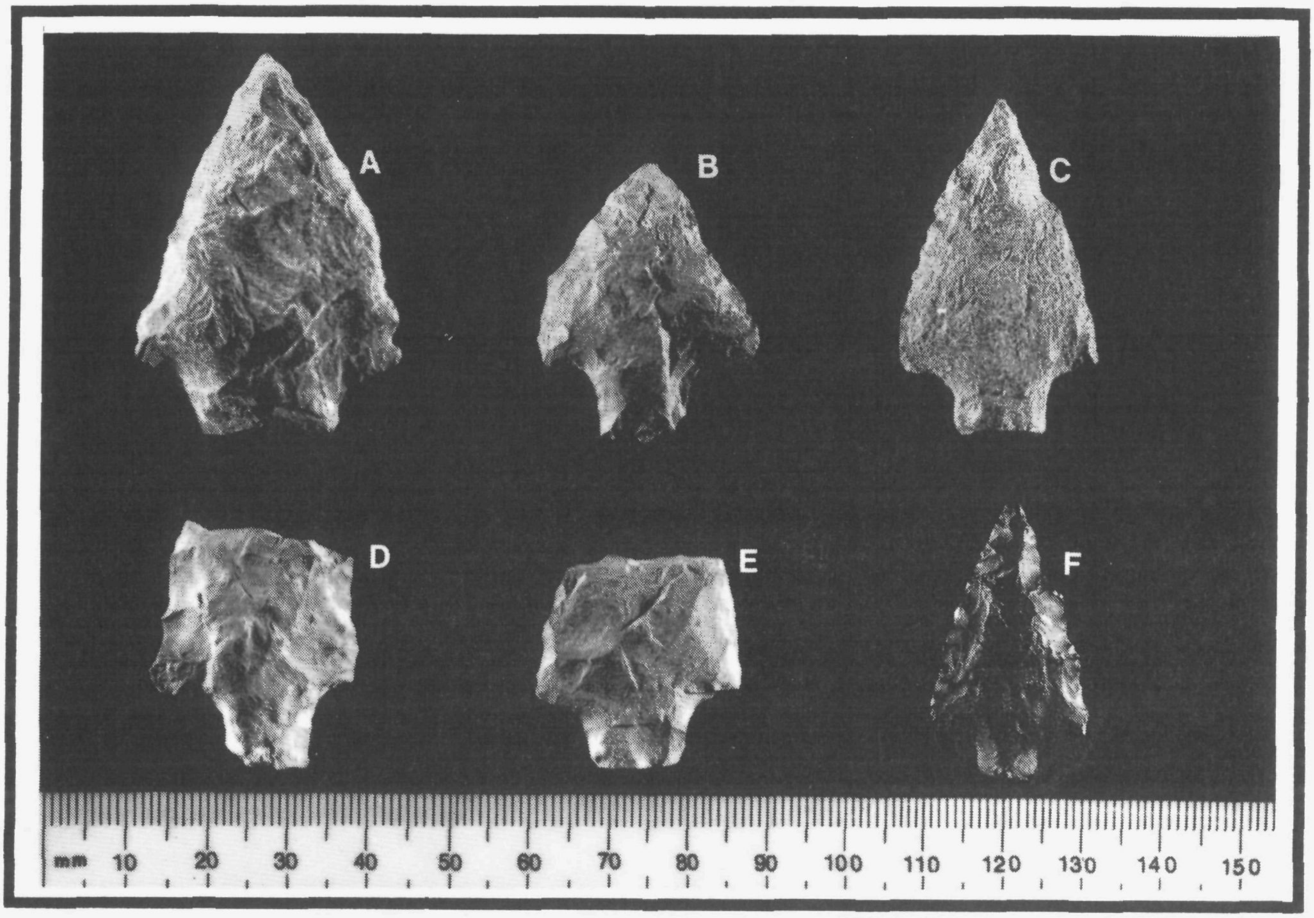


PLATE 12: Small Savannah River Points (circa 2000 - 1000 BC)

A Rhyolite (Cat. # 2760)
B Rhyolite (Cat. # 1166)
C Rhyolite (Cat. # 1090)
D Rhyolite (Cat. # 2799)
E Rhyolite (Cat. # 2420)
F Hematite (Cat. # 1292)

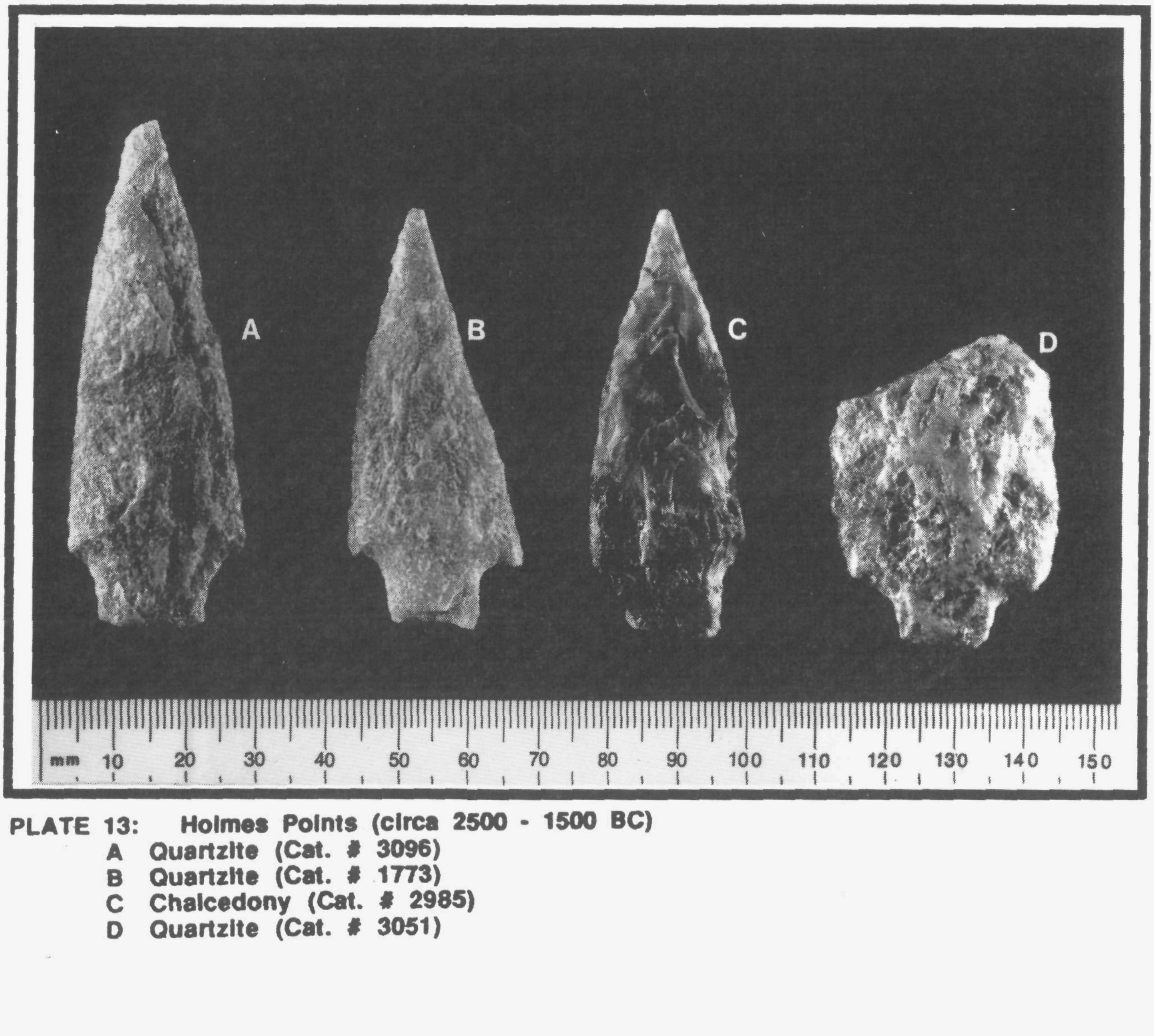


PLATE 13: Holmes Points (circa 2500 - 1500 BC)
A Quartzite (Cat. # 3096)
B Quartzite (Cat. # 1773)
C Chalcedony (Cat. # 2985)
D Quartzite (Cat. # 3051)

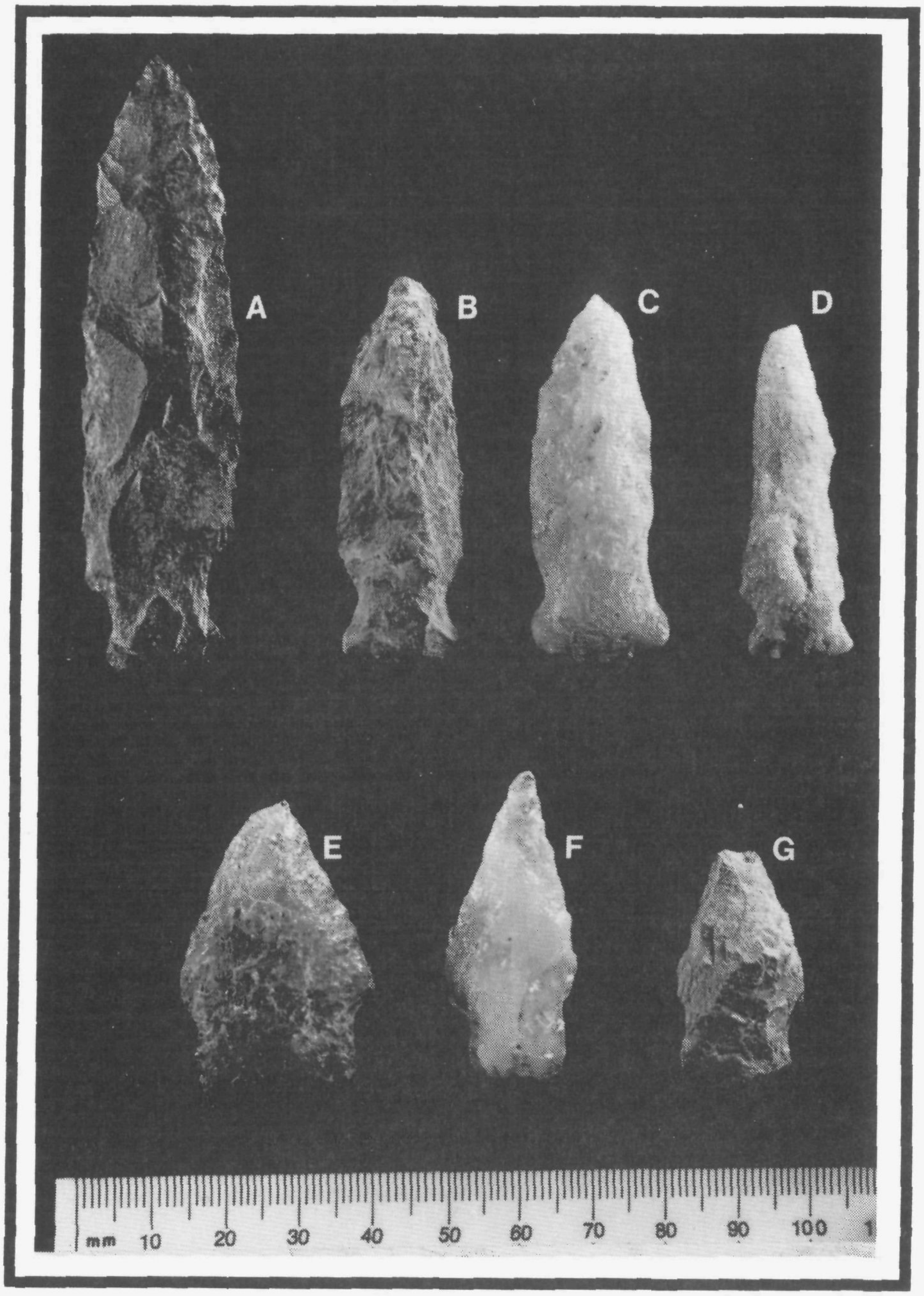


PLATE 14: Lackawaxen (circa 2500 - 1500 BC) and Calvert Points (circa 1200 - 1000 BC)

A Chalcedony Lackawaxen (Cat. # 2699)
B Rhyolite Lackawaxen (Cat. # 1531)
C Quartzite Lackawaxen (Cat. # 2074)
D Quartzite Lackawaxen (Cat. # 1740)
E Quartz Calvert (?) (Cat. # 1933)
F Quartz Calvert (?) (Cat. # 3071)
G Rhyolite Calvert (?) (Cat. # 3012)

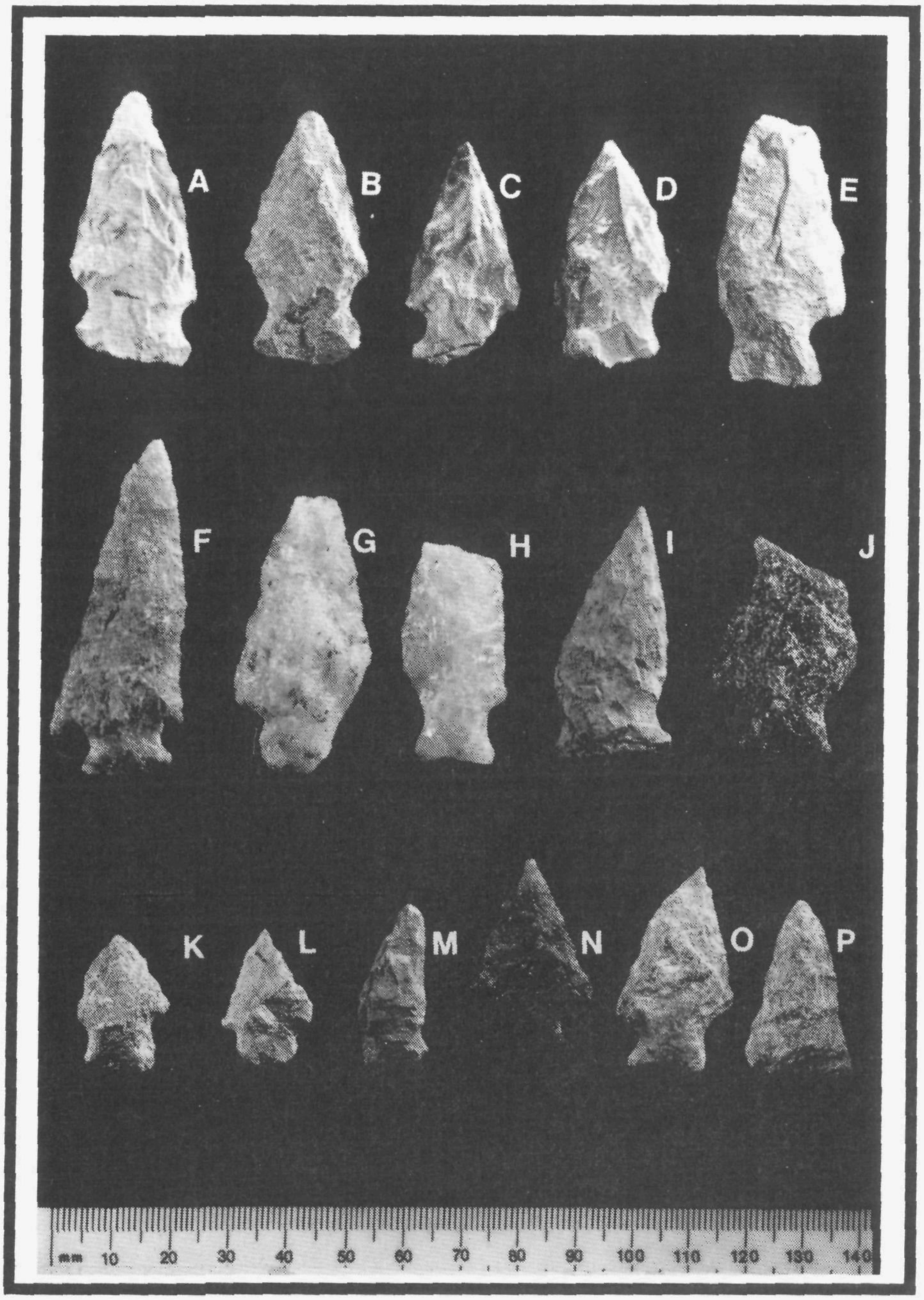


PLATE 15: Untyped Points

A	Rhyolite (Cat. # 2154)	I	Rhyolite (Cat. # 1443)
B	Rhyolite (Cat. # 1430)	J	Quartzite (Cat. # 2923)
C	Rhyolite (Cat. # 1811)	K	Rhyolite (Cat. # 2528)
D	Rhyolite (Cat. # 2187)	L	Rhyolite (Cat. # 2137)
E	Rhyolite (Cat. # 2269)	M	Rhyolite (Cat. # 1967)
F	Quartzite (Cat. # 2581)	N	Quartzite (Cat. # 2901)
G	Quartz (Cat. # 2686)	O	Rhyolite (Cat. # 1874)
H	Quartz (Cat. # 1276)	P	Rhyolite (Cat. # 2742)

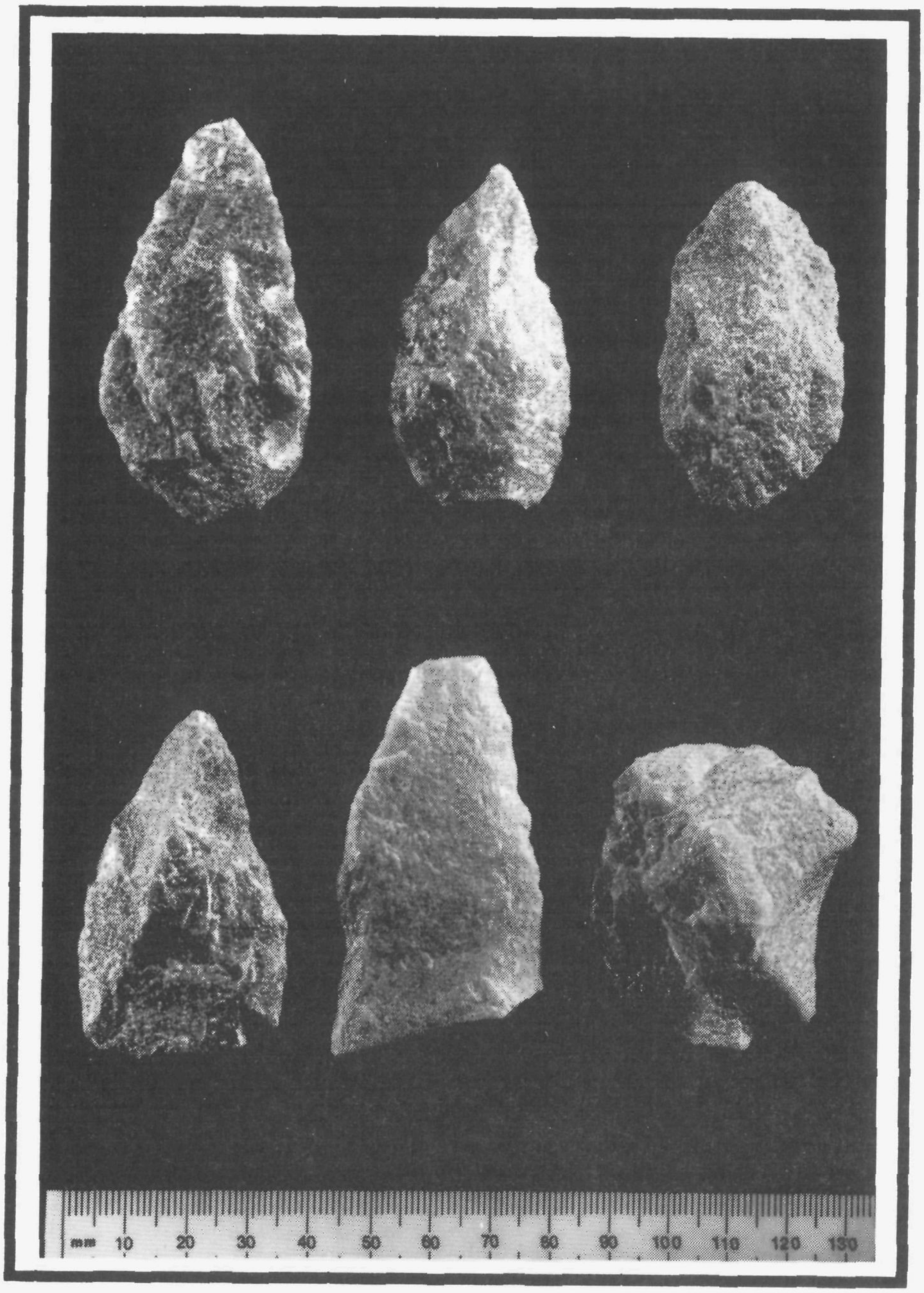


PLATE 16: Cache of Quartzite Bifaces (Feature 29)

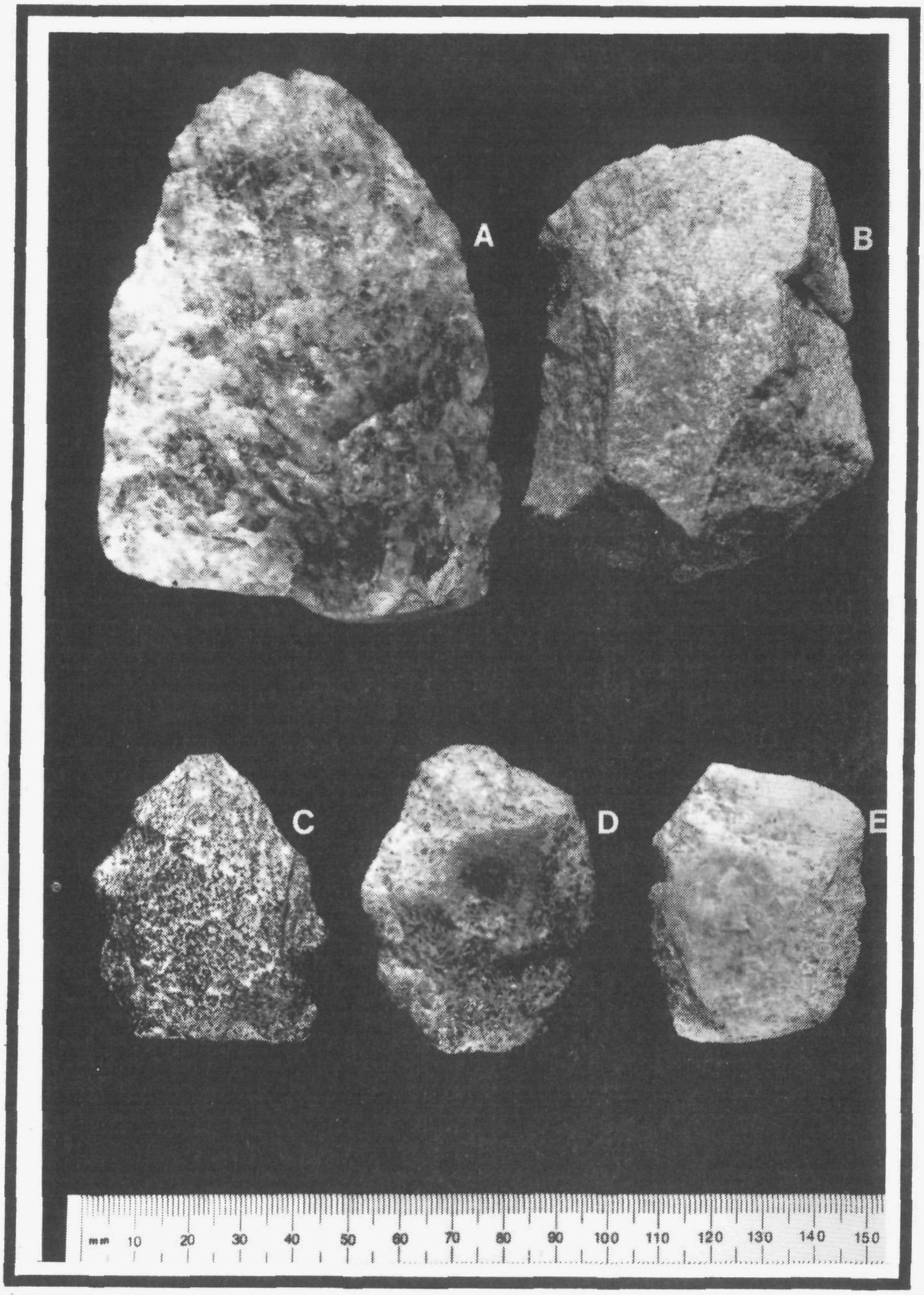


PLATE 17: **Early-Stage Bifaces**

A	Quartz (Cat. # 2394)
B	Quartzite (Cat. # 2044)
C	Quartzite (Cat. # 2176)
D	Quartz (Cat. # 1118)
E	Quartz (Cat. # 2054)

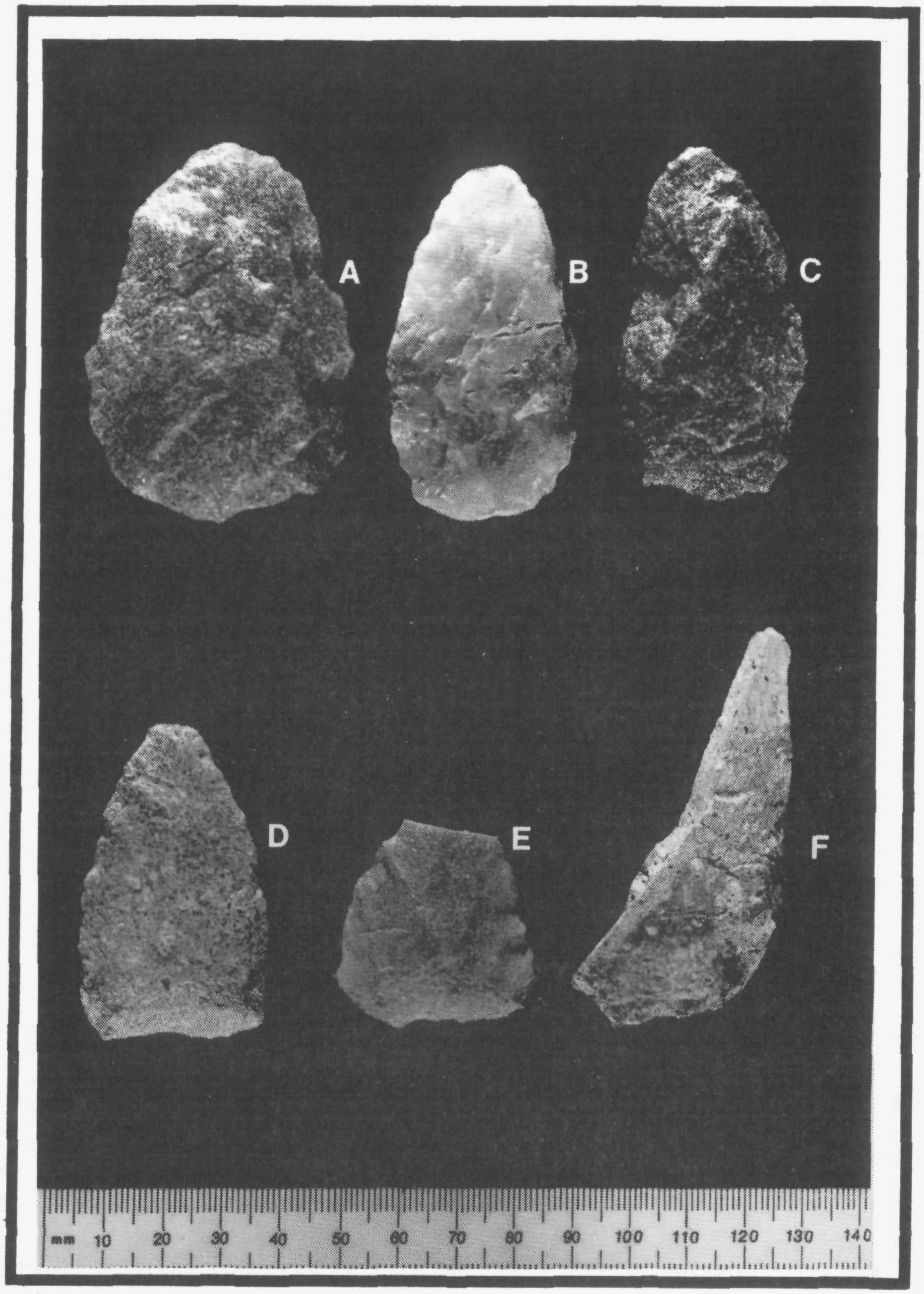


PLATE 18: **Middle-Stage Bifaces**
A Quartzite (Cat. # 2446)
B Quartz (Cat. # 3085)
C Quartzite (Cat. # 2564)
D Quartzite (Cat. # 2099)
E Quartzite (Cat. # 1731)
F Rhyolite (Cat. # 1460/1462 crossmend)

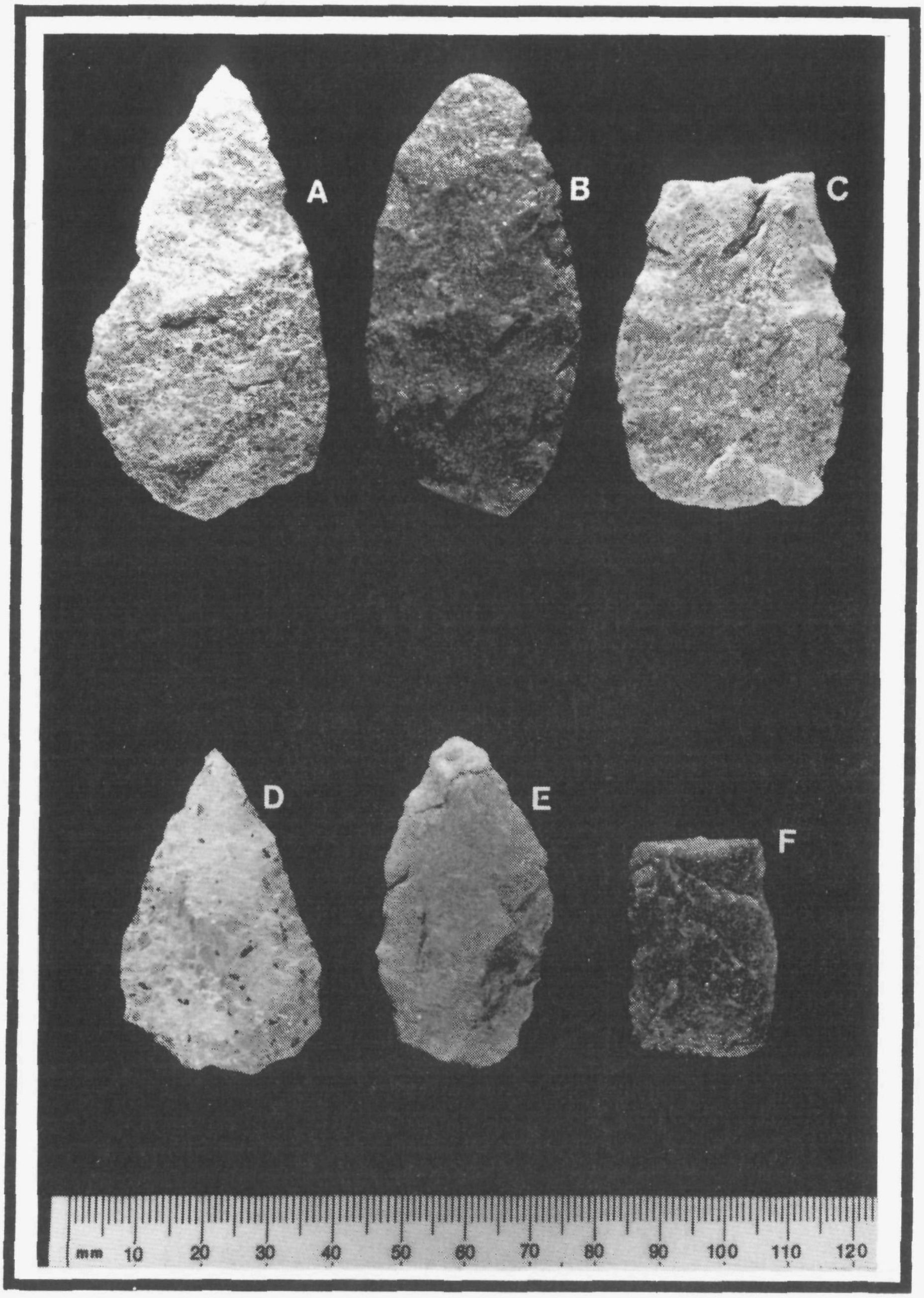


PLATE 19: Late-Stage Bifaces
A Quartzite (Cat. # 1771)
B Quartzite (Cat. # 2734)
C Quartzite (Cat. # 2987)
D Quartz (Cat. # 1366)
E Quartzite (Cat. # 2344)
F Quartzite (Cat. # 1083)

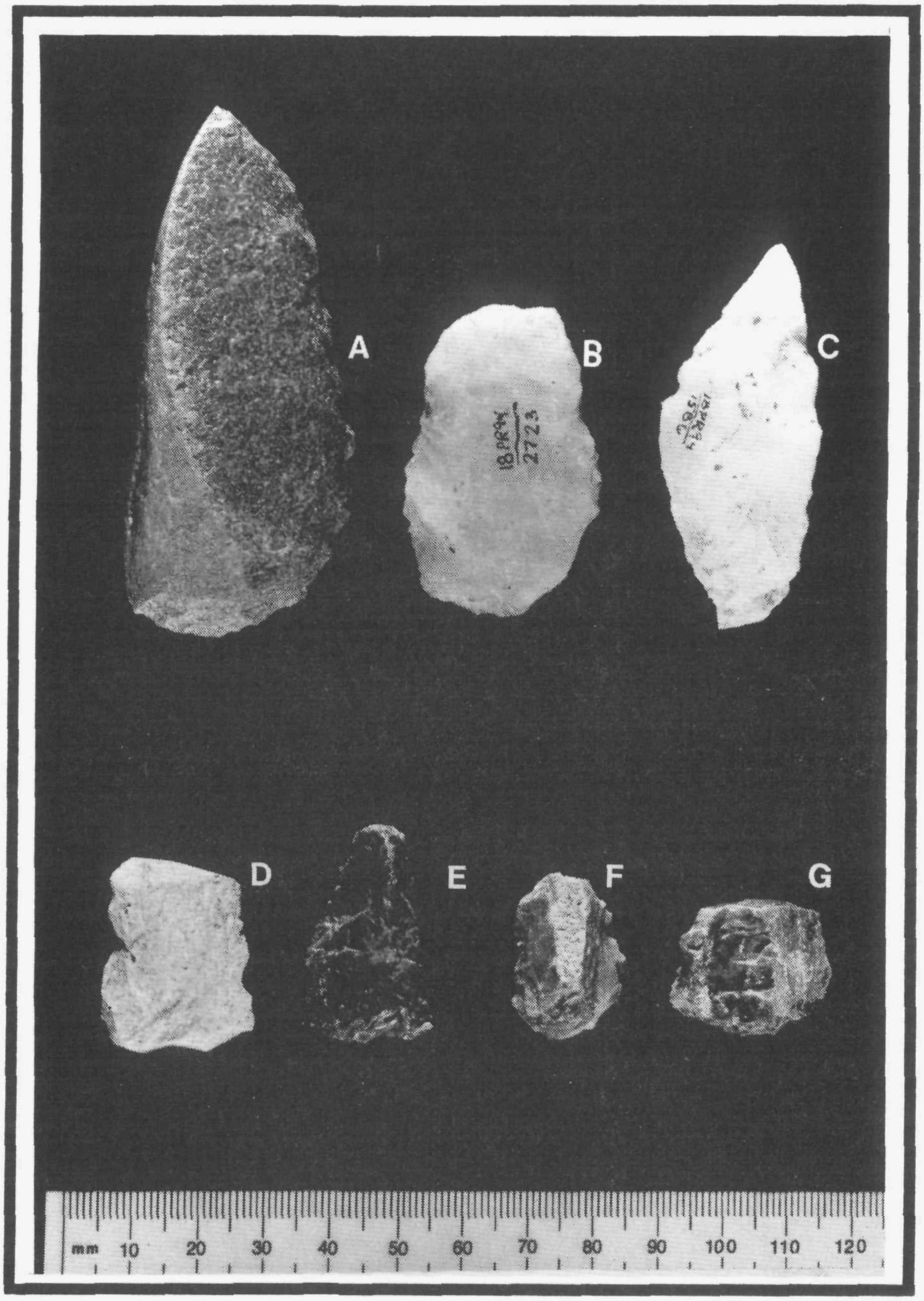


PLATE 20: Unifaces

A Quartzite End/Sidescraper (Cat. # 3103)
B Quartz Endscraper (Cat. # 2723)
C Quartz Sidescraper (Cat. # 1586)
D Chert Endscraper (Cat. # 1225)
E Chert Endscraper (Cat. # 2969)
F Chert Endscraper (Cat. # 2719)
G Chert Endscraper (Cat. # 1226)

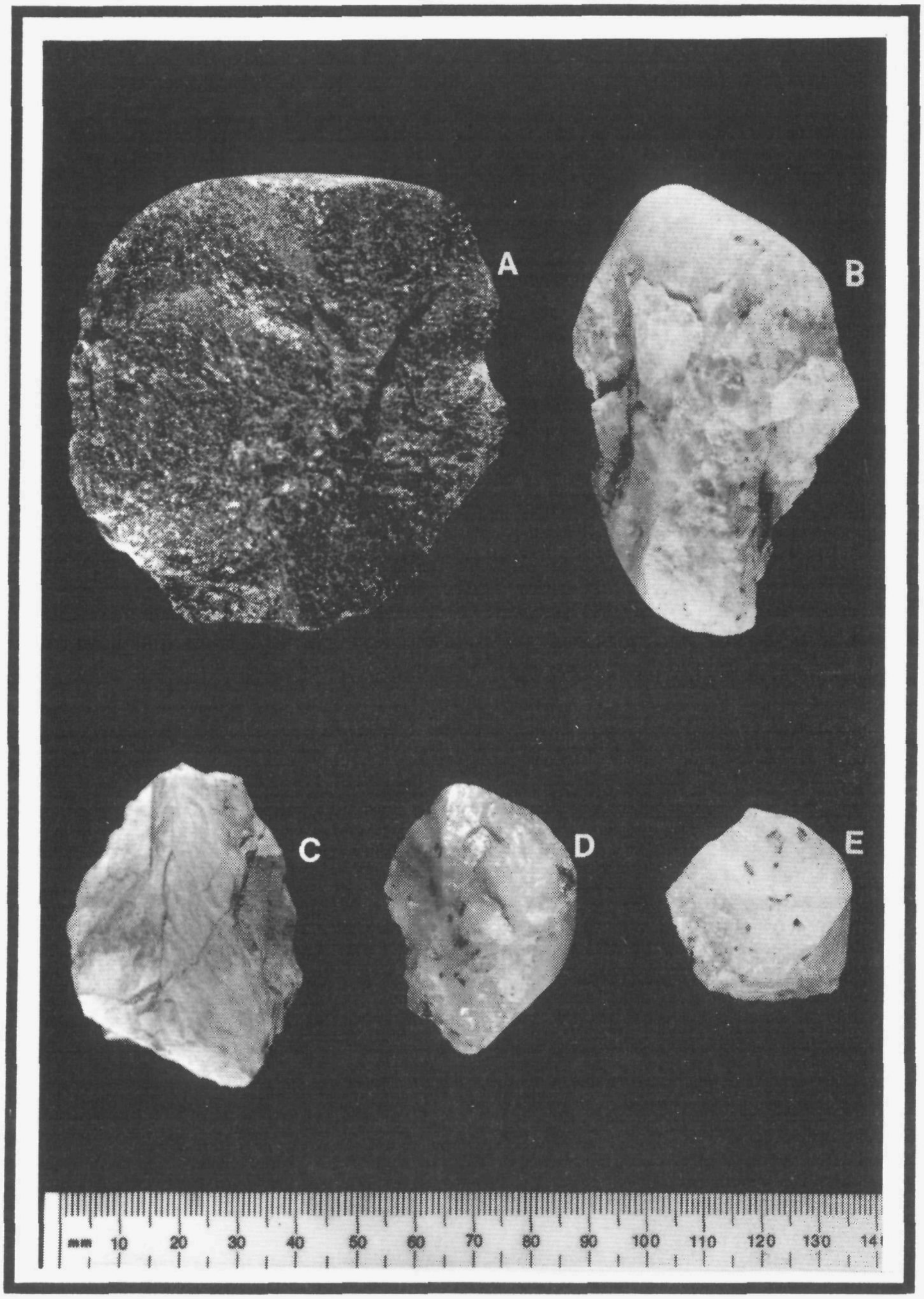


PLATE 21: Polymorphic (Freehand) Cores
A Quartzite (Cat. # 2763)
B Quartz (Cat. # 2906)
C Rhyolite (Cat. # 2060)
D Quartz (Cat. # 1901)
E Quartz (Cat. # 1835)

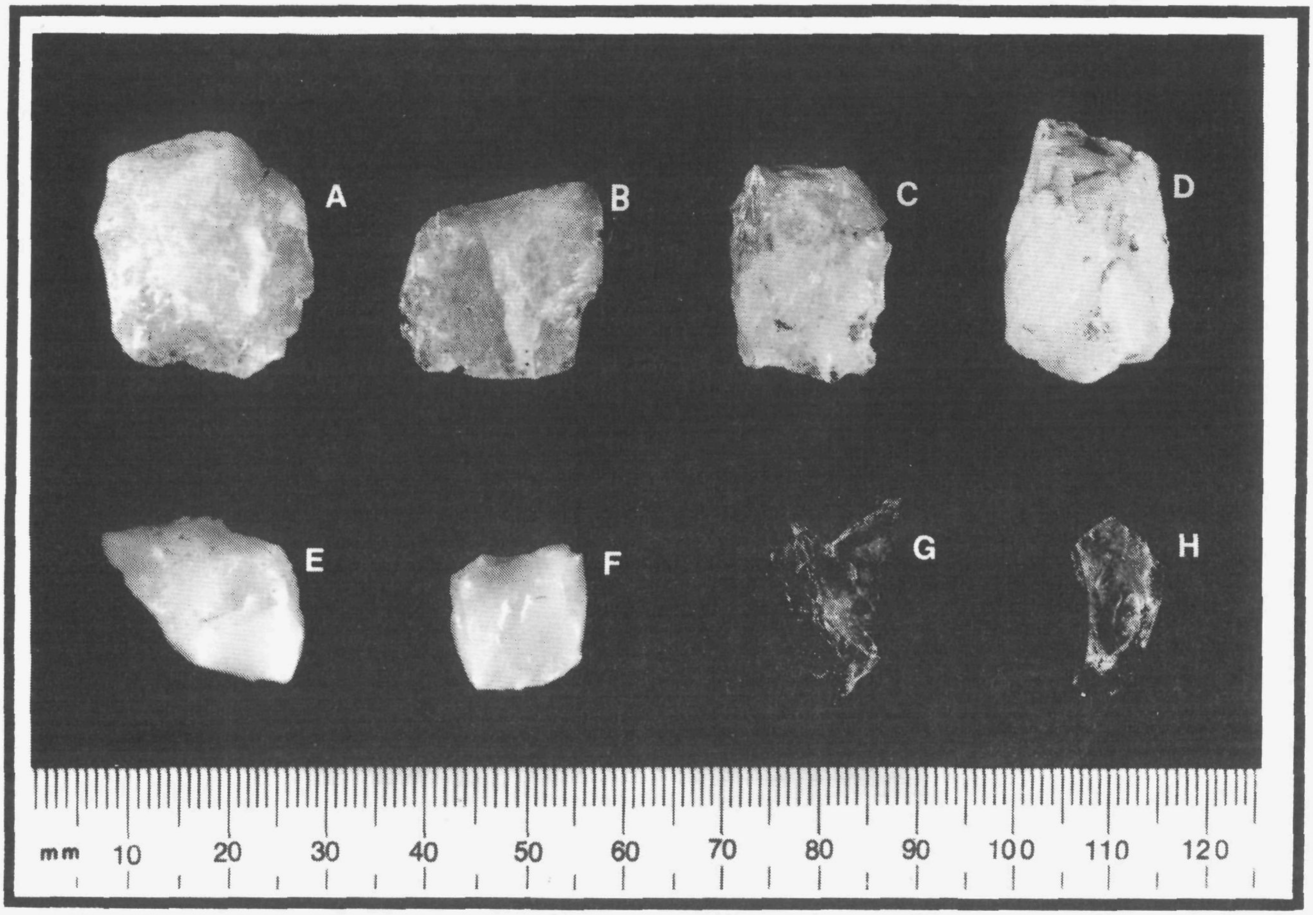


PLATE 22: Bi-Polar Cores

A	Quartz	(Cat. # 3070)
B	Quartz	(Cat. # 2620)
C	Quartz	(Cat. # 2952)
D	Quartz	(Cat. # 2018)
E	Quartz	(Cat. # 1766)
F	Quartz	(Cat. # 1979)
G	Chert	(Cat. # 2585)
H	Chert	(Cat. # 2952)

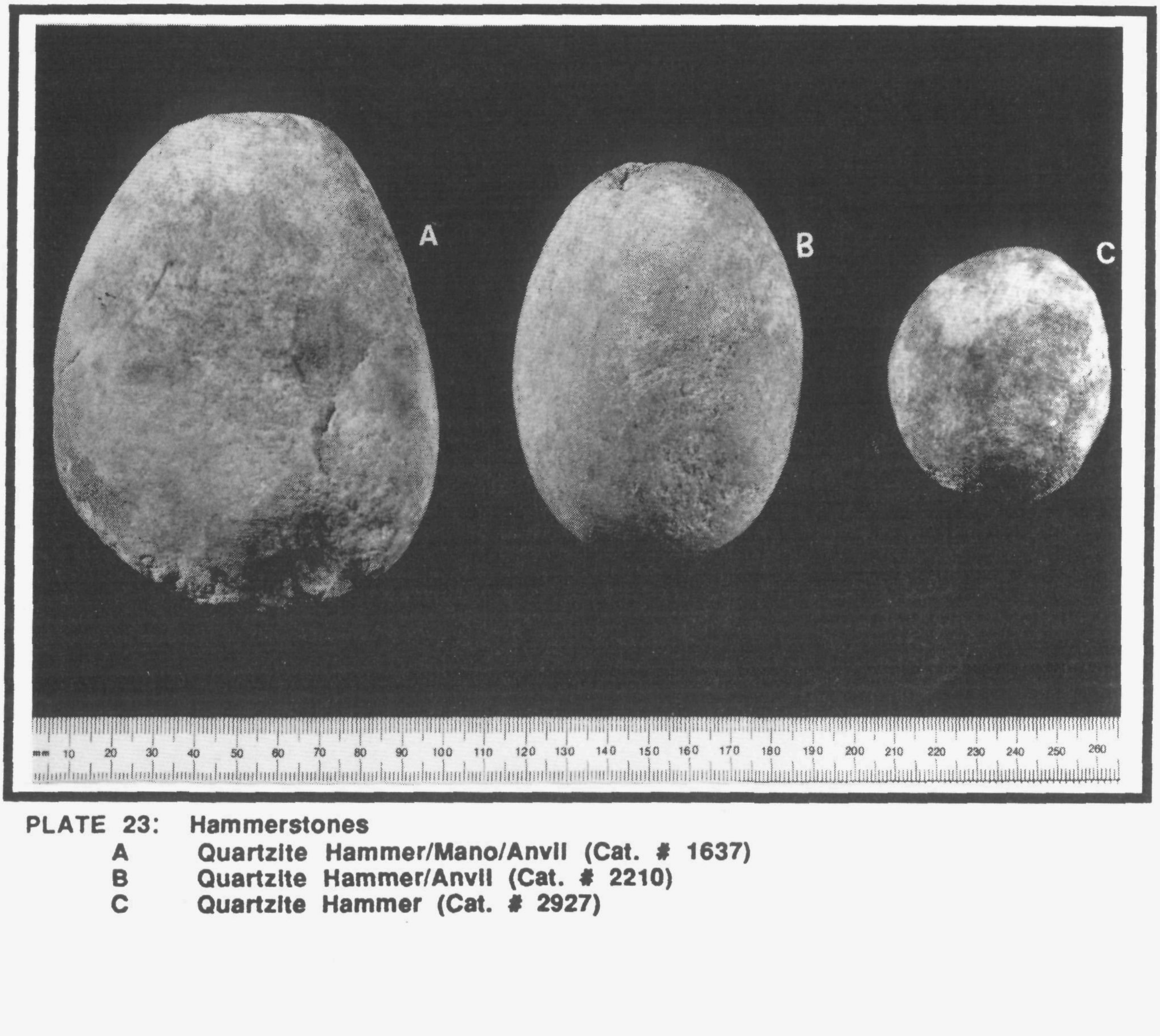


PLATE 23: Hammerstones

A Quartzite Hammer/Mano/Anvil (Cat. # 1637)

B Quartzite Hammer/Anvil (Cat. # 2210)

C Quartzite Hammer (Cat. # 2927)

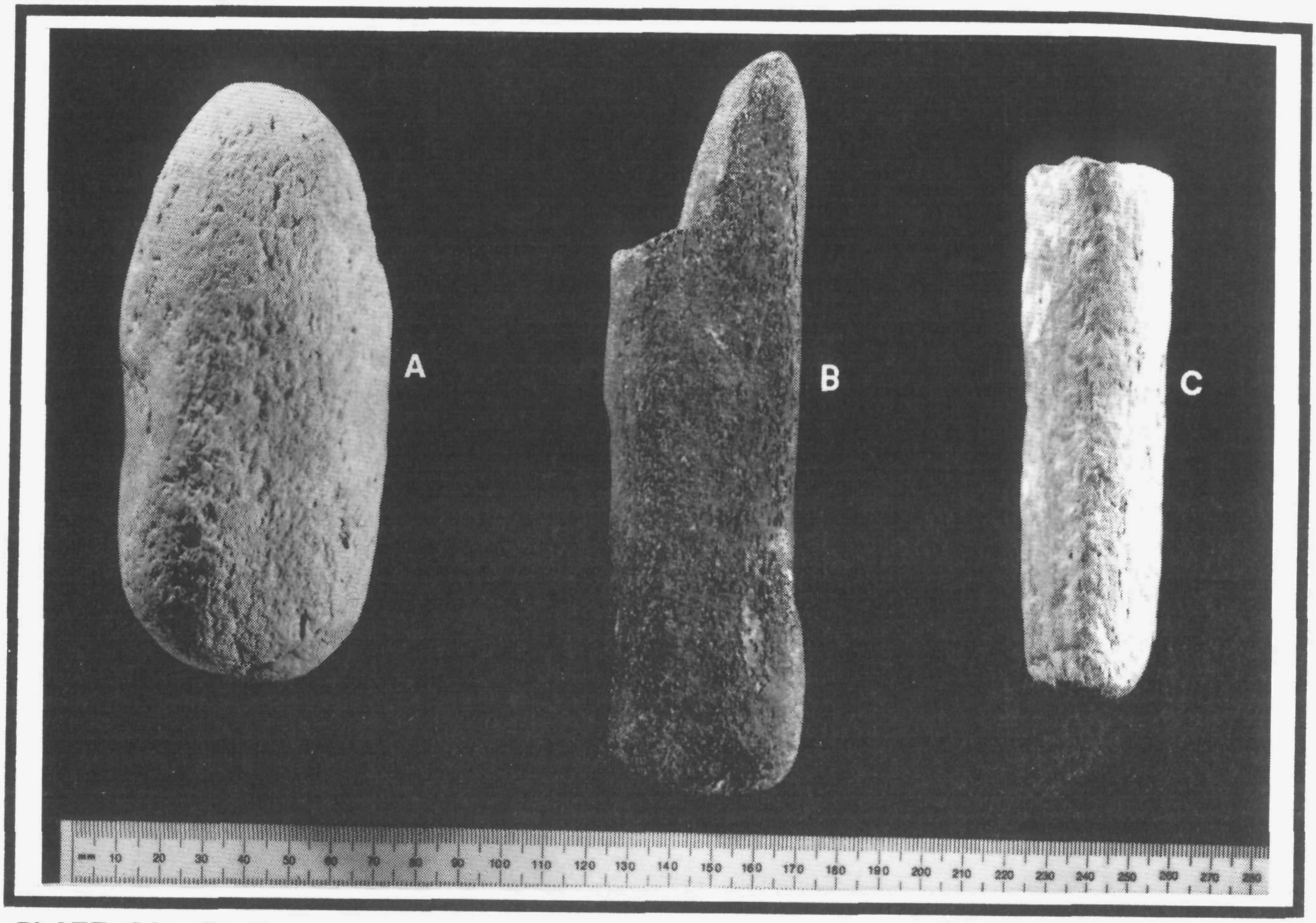


PLATE 24: Pestles

A Quartzite (Cat. # 2386)
B Schist (Cat. # 1183)
C Schist (Cat. # 1601)

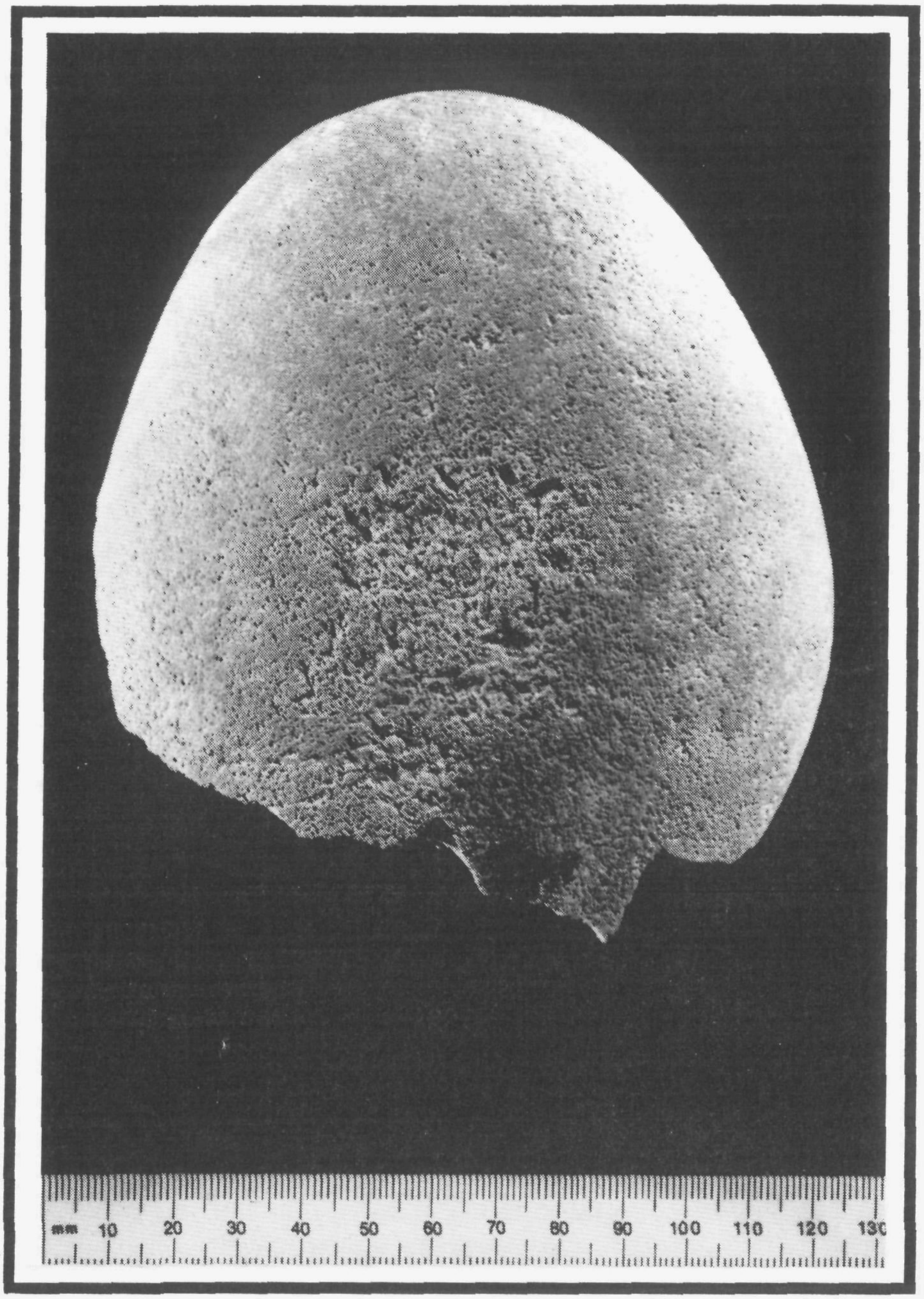


PLATE 25: Anvil, Quartzite (Cat. # 2370)

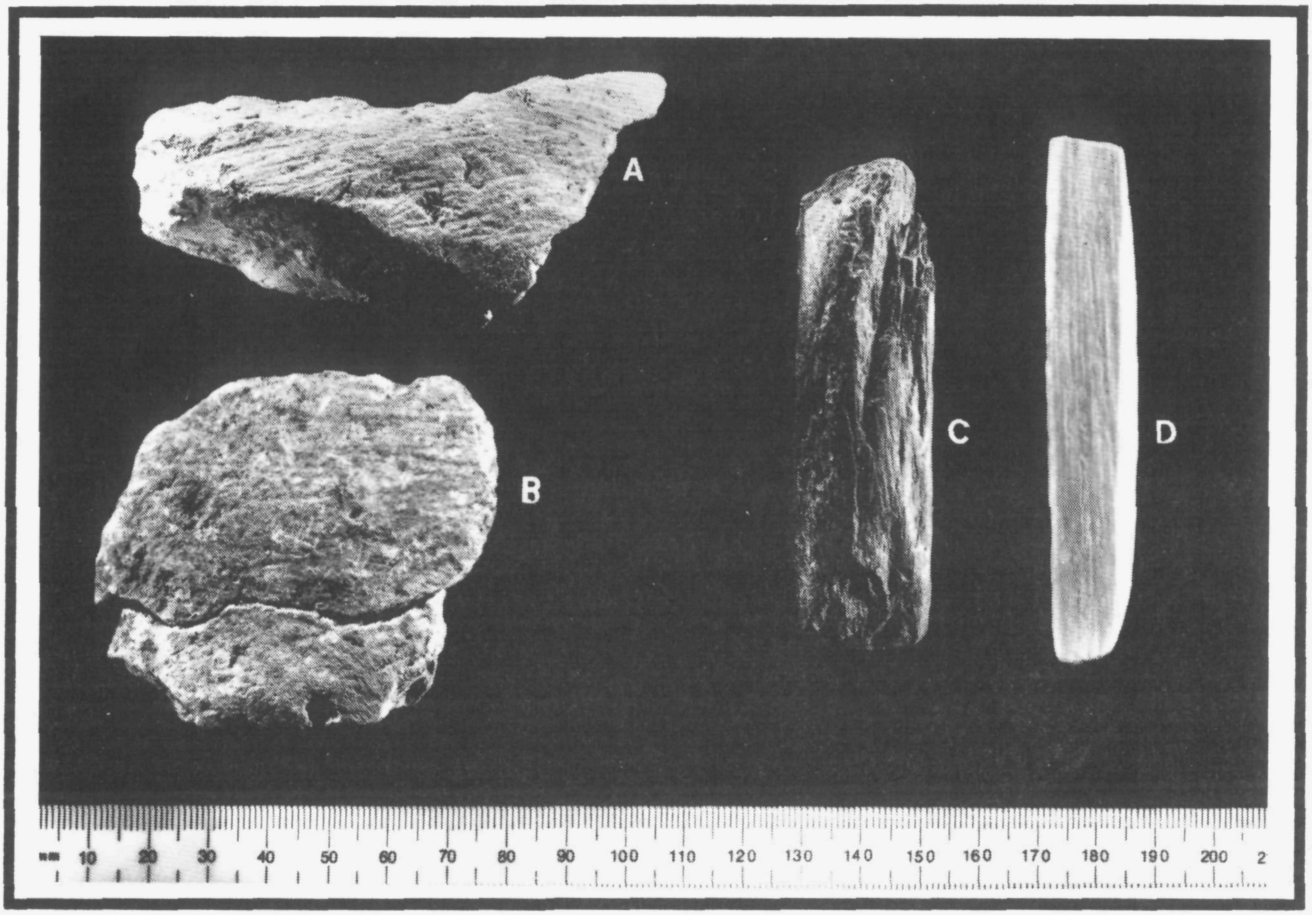


PLATE 26: Groundstone Tools and Petrified Wood

A Steatite Bowl Fragment (Cat. # 1403)
B Steatite Bowl Fragment (Cat. # 1049)
C Schist Tool (Cat. # 1516)
D Petrified Wood (Cat. # 3008)

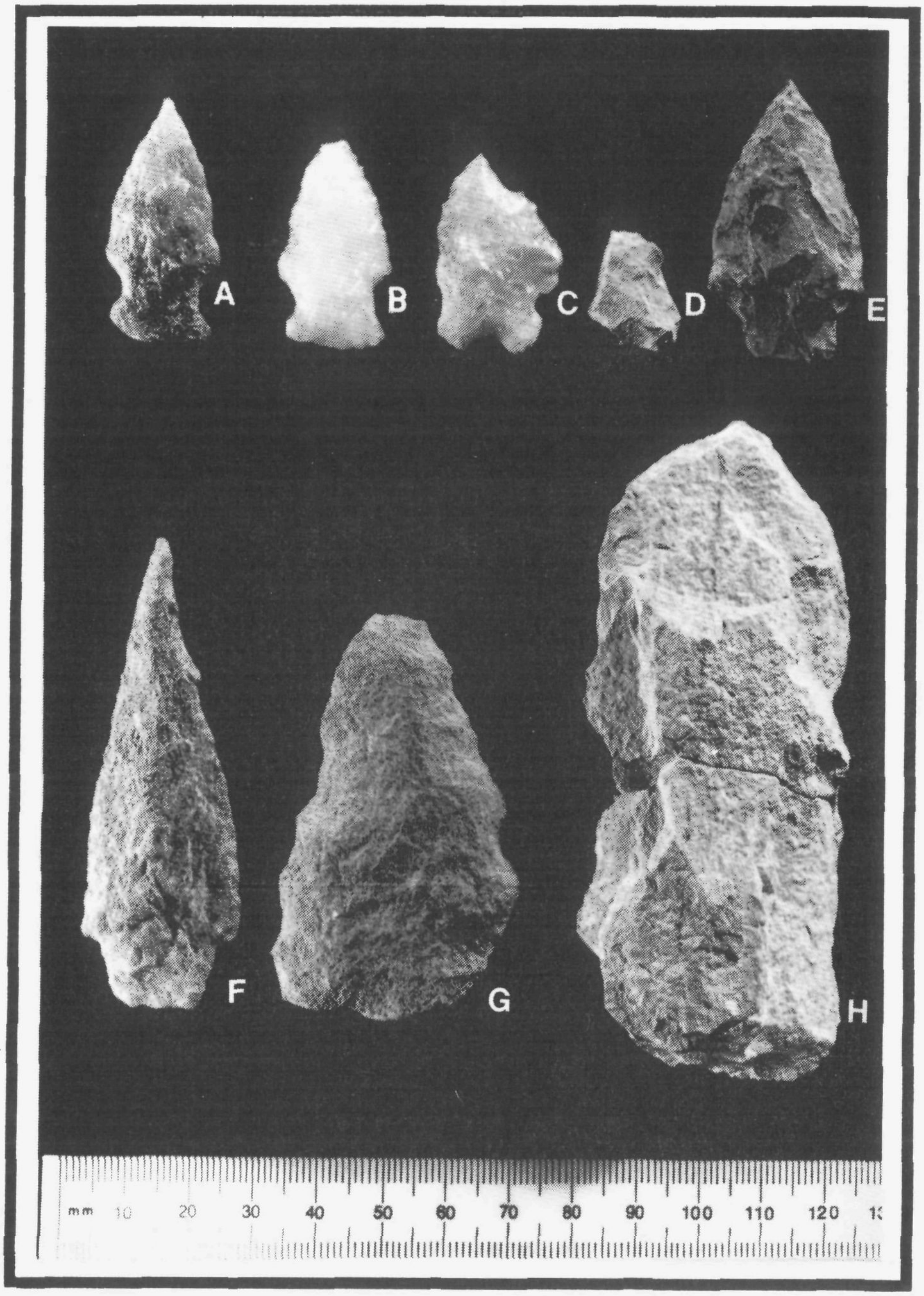


PLATE 27: Bifaces with Blood Residue

- A Quartzite Vernon/Halifax Point (Cat. # 2620)
- B Quartz Vernon/Halifax Point (Cat. # 1484)
- C Quartz LeCroy Point (Cat. # 2707)
- D Rhyolite Bifurcated Base Point (Cat. # 2591)
- E Chalcedony Small Savannah River Point (Cat. # 2581)
- F Quartzite Holmes Point (Cat. # 2734)
- G Quartzite Middle Stage Biface (Cat. # 2240)
- H Rhyolite Middle Stage Biface (Cat. # 1405/1503 crossmend)

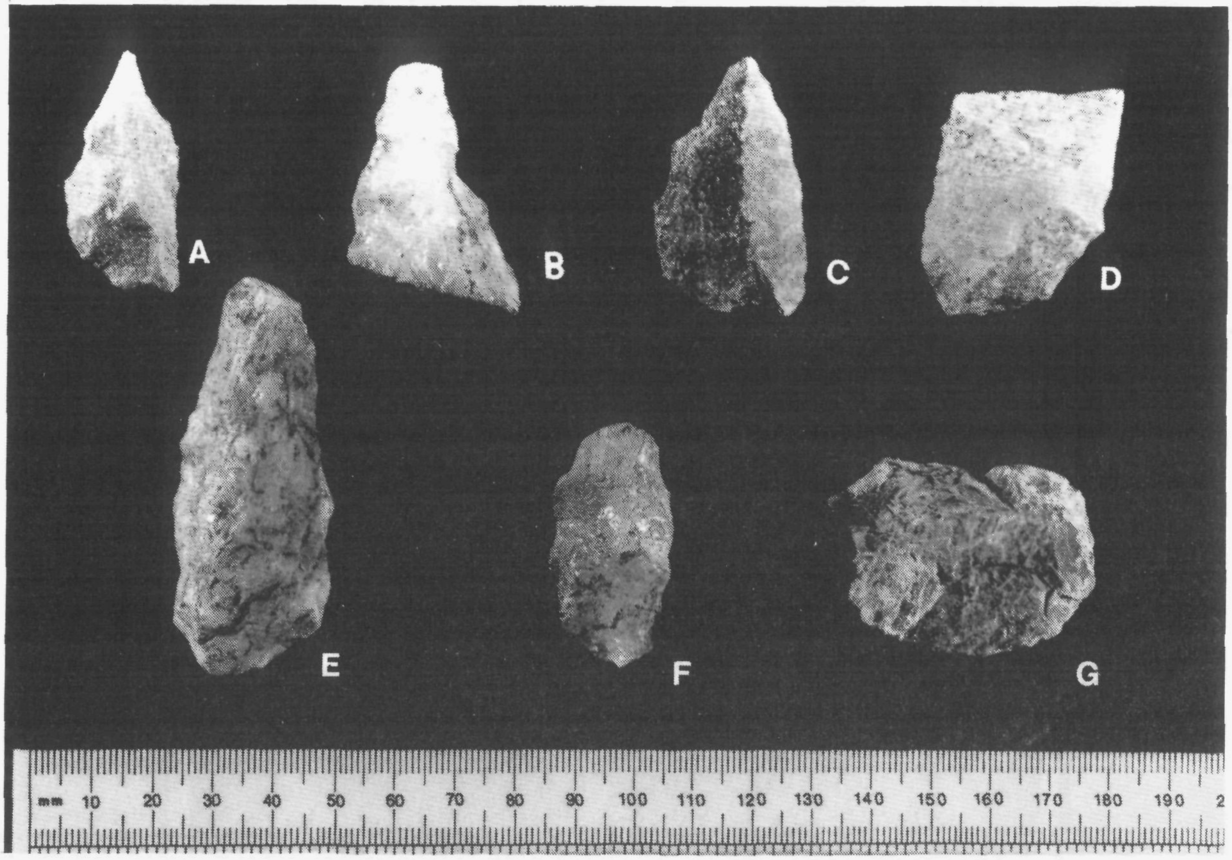


PLATE 28: Tools and Debitage with Blood Residue

A Quartzite Biface Fragment (Cat. # 1116)
B Quartz Flake (Cat. # 1916)
C Quartzite Flake (Cat. # 1484)
D Quartz Flake (Cat. # 1379)
E Quartz Biface (Cat. # 2184)
F Quartz Biface (Cat. # 2252)
G Chalcedony Core (Cat. # 1215)

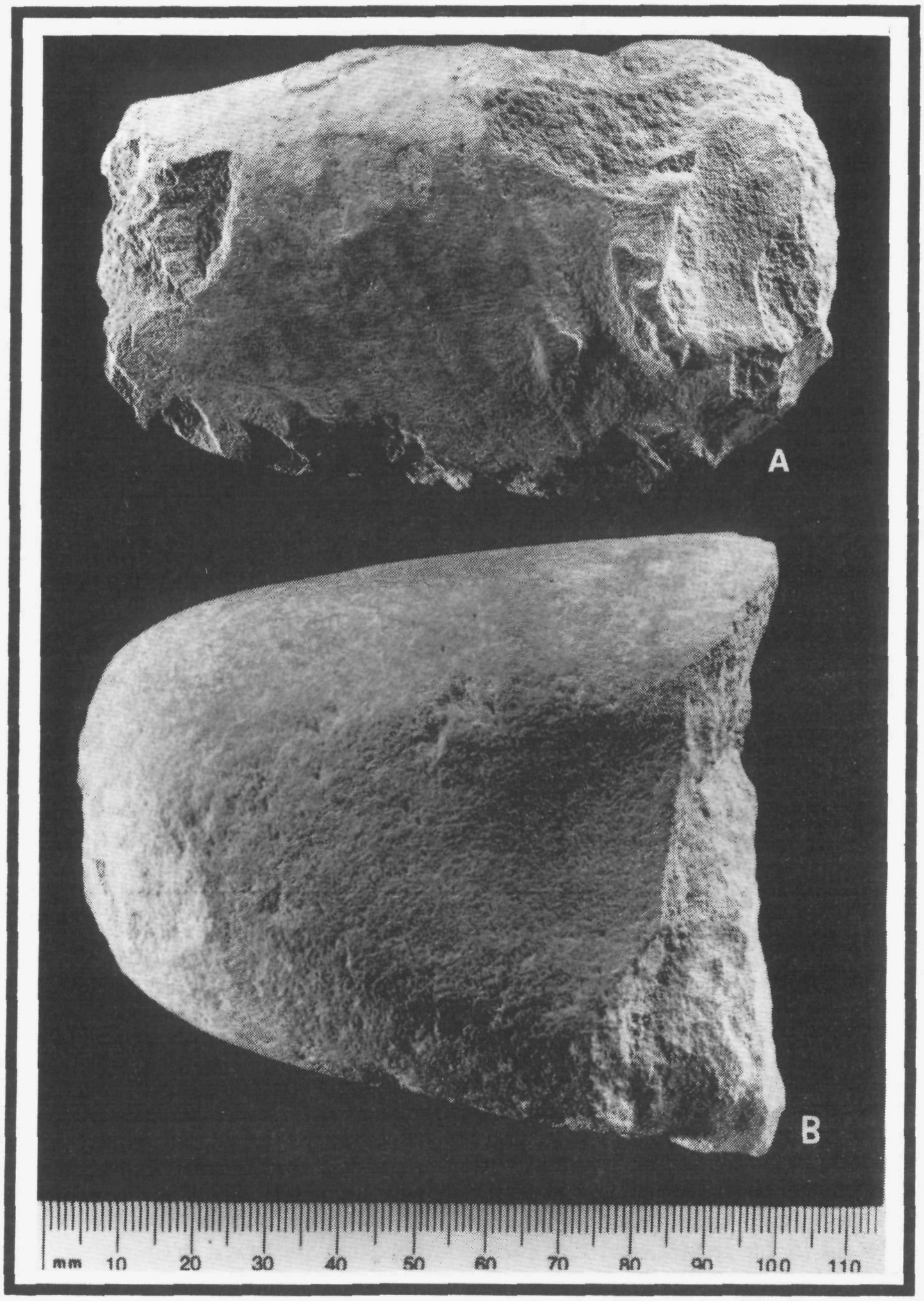


PLATE 29: Biface and Cobble Tool with Blood Residue
A Quartzite Biface (Cat. # 3103)
B Quartz Cobble Tool (Cat. # 2779)

VIII. INTRASITE PATTERNING OF LITHIC REMAINS

A. INTRODUCTION

This chapter examines the internal patterning of the site, focusing on the spatial distribution of lithic raw materials, artifact types, and features. A discussion of the intra-site distribution of the floral assemblage is contained in Chapter IX. Using data from all phases of excavation, intrasite patterning is explored, focusing on the block excavation areas. Investigation of the site structure focuses not only on the identification and spatial delineation of activity areas, but also on site formation, which is a closely related issue. Given the lengthy period during which the site was utilized by hunter-gatherer groups, and its shallow depth, there is no doubt that many different activities were carried out within the same relatively restricted space. Notwithstanding the preservation of features in subsoil contexts, the mixing of material associated with different occupational periods and their associated activities has occurred, although there is evidence that the deposits are weakly stratified. While some episodes of site use may have been quite restricted spatially, the total succession of occupational episodes has produced a complex of overlapping patterns.

Identification of activity areas within the site proceeds from the basic assumption that patterning in the archaeological record reflects patterns of cultural behavior. It is known that there are many processes that result in post-depositional displacement of artifacts from their discard location, resulting in distortion of the original patterns of discard that would have been visible when artifacts first entered the archaeological record as a result of loss, discard, or abandonment. During analysis of intrasite patterning, one must be aware not only of natural post-depositional distortions, but also of the various cultural behaviors associated with the disposal of refuse. Schiffer's (1972) classification of primary, secondary, and de facto refuse indicates that material may enter the archaeological record through a broad range of behaviors. In particular, it is important to realize that some items may enter the archaeological record at their location of use (e.g., by loss or abandonment), while other items may be discarded away from their location of use (e.g., by the deposition of refuse away from a habitation area).

Archaeological features that represent architectural elements or facilities are generally assumed to represent primary or in situ refuse. At the Indian Creek Site, the FCR features have been interpreted as cooking areas located within the site's habitation area, and these features are assumed to represent relatively permanent facilities that have remained in their original location of use. Based on that assumption, the site features are used as points of reference for analysis of the distributional patterning of lithic tools and debris. It is recognized that tools may have been reused during the site's occupation and that refuse may have been redeposited in an effort to maintain cleanliness within the habitation area. Although the intrasite distribution of tools and debitage is assumed to provide a relatively accurate representation of the location of discard activities, it must be recognized that use locations may differ from discard locations.

Depositional planes or occupational surfaces have been obscured to a degree that limits analysis of the deposits according to vertical provenience. Initial exploratory analysis failed to identify discrete depositional planes or living floors that corresponded to the excavation levels; therefore analysis of the vertical distribution of material was limited to two contexts: plowzone and subsoil. There is extensive horizontal overlapping of point types representing the Early Archaic and Late Archaic occupation of Area 3, and given the shallow depth of deposits and the loose, sandy soils, it is not possible to construct horizontally-defined analytical units that represent specific chronological periods or phases of the site's occupation.

Given this situation, it is most appropriate to examine the site's internal structure by focusing on selected elements of the artifact assemblage such as diagnostic projectile points, tools, and raw materials. While there was only limited evidence of vertical stratigraphy, clusters and concentrations of specific tools and raw materials were in many cases readily apparent, indicating the presence of horizontally well-defined activity areas.

The methodology used to examine the site's internal structure involved a combination of computer-assisted statistical techniques and visual examination of manually plotted distribution maps. Flakes and chunks (angular shatter) were treated as a single analytical category designated "debitage" for the examination of intrasite patterning. Concentrations of debitage were identified from examination of density distribution maps, for each raw material, which were based on computer summaries indicating the amounts of debitage according to provenience. Definition of debitage concentrations was based on the computed mean and standard deviation values for each unit or subsoil quadrant. In general, the density distributions were highly skewed, and in many cases the mean and standard deviation values were quite close. In most cases, six density ranks were defined, based on the computed mean and standard deviation values for each material. In most cases, the following cut-off points were used:

zero
mean - 1/2 standard deviation
mean
mean + 1 standard deviation
mean + 2 standard deviations

In the following discussion, the terms "low," "moderate" and "high" apply to successive gradations along this scale, and "concentration" applies to densities greater than the mean plus 2 standard deviations. Density distributions were examined separately for the plowzone and subsoil, and in most cases there was a general concurrence between the two context types. Distributions in subsoil were plotted according to 2.5x2.5-foot quadrants, while the plowzone distributions were plotted according to the 5x5-foot units. The clustering of tools was identified by simple visual inspection of distribution maps.

The internal site structure is discussed and illustrated according to seven excavation blocks which together constitute 83 percent of the site's areal sample and which include all of the features. The remainder of the sample is represented by scattered units and shovel tests. Figure 31 provides a base map of the blocks and units.

The distribution of features throughout the site is shown in Figures 19-22. Because the excavation strategy focused on excavation of block areas around features, it follows that all features are contained within the excavation blocks rather than in the scattered units. Thirty of the 35 features are contained in Blocks 4, 5, and 6, and these blocks encompass two-thirds of the area excavated in Area 3 (Table 21). The occurrence of features within the blocks varies considerably between the blocks. Block 6 represents the largest areal sample of Area 3, and with 18 features it exhibits the highest overall feature density, with the exception of Block 1.

B. RESULTS

1. Biases and Limitations in the Database

Before moving to a discussion of the distribution of artifacts within the site, it is appropriate to identify known biases and limitations in the database. This is necessary in order to clearly distinguish patterns in the archaeological record that directly reflect site formation processes and the behavior of the prehistoric hunter-gatherer groups that occupied the site, as opposed to patterns that might arise from differences in excavation methods or the artifact cataloging procedures.

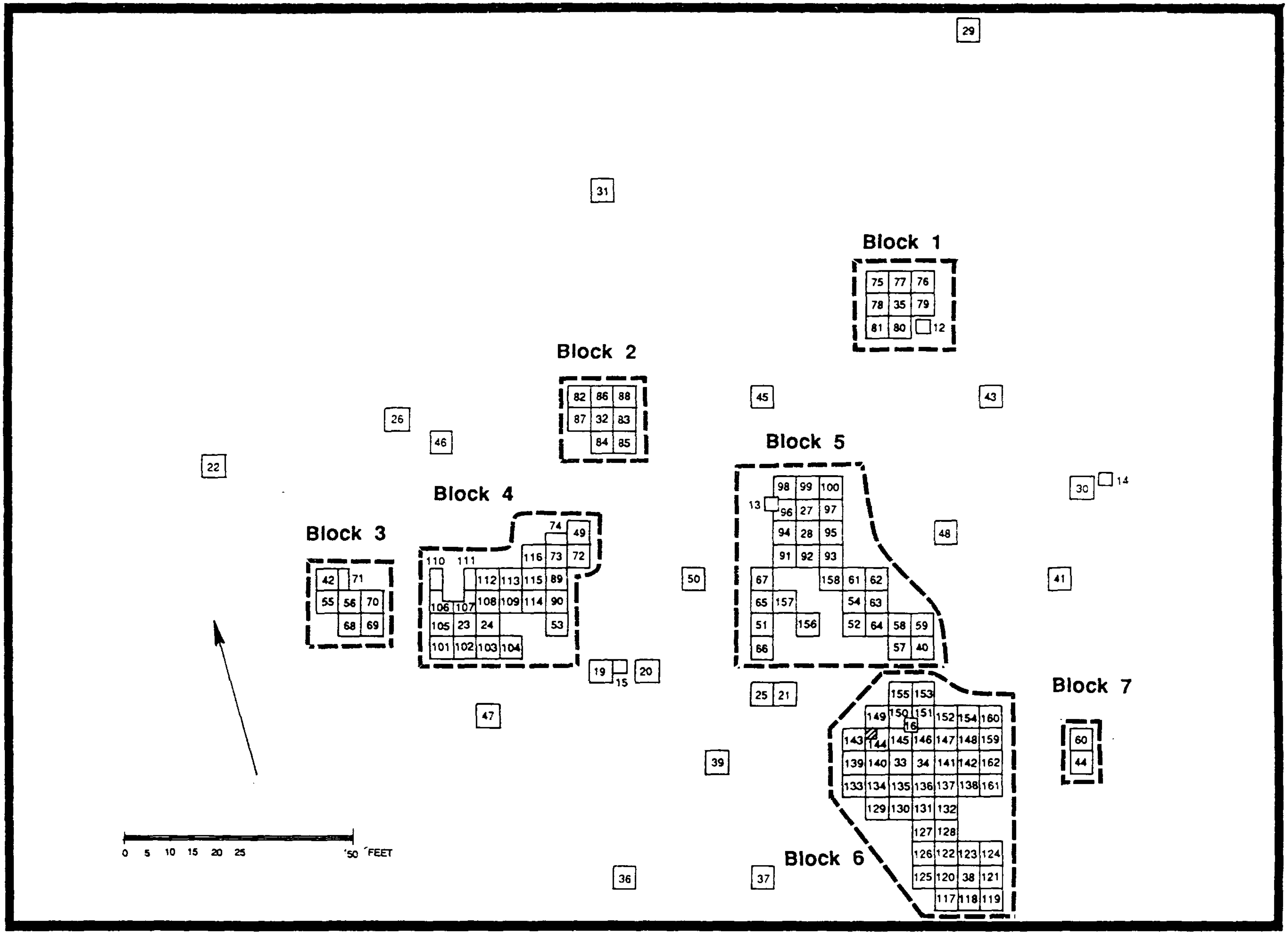


FIGURE 31: Base Map of Excavation Blocks and Units

TABLE 21. DISTRIBUTION OF FEATURES IN EXCAVATION BLOCKS.

EXCAVATION BLOCK	AREA (square feet)	NO. OF FEATURES	DENSITY(square feet/feature)
1	209	3	70
2	200	1	200
3	162.5	.	.
4	575	4	144
5	730	8	91
6	1150	18	64
7	50	1	50

Throughout the three phases of field excavation, consistent recovery methods were employed, and the same artifact cataloging system was employed during all phases of analysis. During the Phase III analysis, much of the Phase I and Phase II collection was reexamined to ensure consistency in the database. This included all tools and a sample of the debitage (flakes, chunks, and fire-cracked rock).

Nonetheless, there are some anomalies in the database that appear to be attributable to the fact that the field excavations were carried out in three discrete phases of work during different seasons of the year. The flake size distributions illustrate this most clearly, as shown in Table 22 and Figure 32. The smallest flake size category is best represented in the material extracted from the flotation samples, and this is related to the small size of the mesh (less than 1 mm) used to extract the heavy flotation fraction. Small flakes are most poorly represented in the Phase III excavation sample. Significant differences in the flake size distribution were not expected for the different phases of excavation, because the same 1/4-inch mesh screen size was used throughout the project. Some of the observed difference is attributable to the real patterning in the archaeological record, as a large portion of the small flakes in the Phase II sample were recovered from a single excavation unit (Test Unit 33) that apparently sampled a tool rejuvenation activity area. However, even when Unit 33 is excluded from analysis, there are significant differences between the samples that can be attributed only to inconsistencies in field recovery. It is believed that these inconsistencies are related to the season during which fieldwork was carried out. The Phase II fieldwork was carried out during September and October 1987 when the weather was mild and the soil was dry--conditions that in retrospect appear to have been ideal. The Phase III fieldwork was carried out during winter and early spring months (January to April) of 1989. It is suggested that the saturated soil conditions during this period may have hindered recognition of small flakes, or there may have been some reluctance on the part of the excavators to take their hands out of their gloves to pick small flakes from the screen during the cold weather conditions. Biases in the database caused by these factors would pertain only to the distributional patterning of micro-debitage; there are no known biases in the recovery of tools or debitage larger than 10 millimeters.

2. Internal Site Structure

a. Cultural Components

The distribution of the diagnostic points provides an indication of which areas of the site were used during the various occupational phases. The Early Archaic occupation of the site is represented by points in the Palmer/Kirk and bifurcated-based clusters. These points were widely distributed throughout the site, but there were a few clusters or concentrations that exhibit a well-defined spatial patterning (Figures 33, 34 and 35). There were two clusters among the 13 Palmer/Kirk points. The best-defined involves 3 points in Unit 89 (Excavation Block 4), of which 2 were recovered from the southwest quad and the third from the plowzone. This cluster of points is in close proximity to Feature 17, a concentration of FCR. A secondary cluster of Palmer/Kirk points

TABLE 22. COMPARISON OF FLAKE SIZES FROM FLOTATION VS. EXCAVATION.

	FLOTATION		PHASE I-II		PHASE III		TOTAL	
FLAKE SIZE	N	%	N	%	N	%	N	%
< 5 mm	183	29.4	971	17.6	23	*	1,177	3.4
6-10 mm	351	56.4	2,653	48.2	4,341	15.4	7,345	21.4
11-20 mm	87	14.0	1,368	24.9	18,243	64.7	19,698	57.4
21-30 mm	1	0.2	341	6.2	3,917	13.9	4,259	12.4
31-40 mm	.	.	120	2.2	1,149	4.1	1,269	3.7
41-50 mm	.	.	35	0.6	350	1.2	385	1.1
51-60 mm	.	.	9	0.2	109	0.4	118	0.3
61-70 mm	.	.	5	0.1	42	0.1	47	0.1
71-80 mm	.	.	2	*	10	*	12	*
81-90 mm	.	.	.	.	1	*	1	*
91-100 mm	.	.	1	*	1	*	2	*
	622	100%	5,505	100%	28,186	100%	34,313	100%

*: less than 0.1%.

was evident in the southeast sector of Excavation Block 6, where 3 points were recovered from Units 38, 119, and 121. Two of the points in this cluster were recovered from subsoil contexts and the third was recovered from the plowzone.

The bifurcated-base group includes LeCroy, St. Albans, Kanawha, and Stanly points. Among the 21 points in this group, there were two clusters. One cluster of 5 points was present in the northeast sector of Block 4, overlapping the Palmer/Kirk cluster centered on Feature 17. The points in this cluster were dispersed over five units, and 4 of the 5 points were recovered from subsoil contexts (see Figure 33). This cluster overlaps an area where there are three FCR features (Features 12, 17, and 19). The largest number of bifurcated-base points was within Block 6, and there was a cluster of 5 points in Units 137, 138, and 142 (see Figure 35); 4 of the 5 points in this concentration were recovered from subsoil contexts, and this cluster overlaps Features 28 and 32. One of the bifurcate points in Block 6 falls within the secondary cluster (Unit 118) of Palmer/Kirk points in the southeast corner of this block; the remainder were found in units that also contained FCR features (Units 33, 143, and 146). The others were recovered from Blocks 1, 2 and 5 (see Figure 34) and from two isolated units.

Late Archaic points in the collection far outnumber those assigned to the two Early Archaic groups. Patterning in the distribution of the Late Archaic points is not so apparent as in the Early Archaic points; however, in some cases this may reflect sample sizes or possible post-depositional dispersal attributable to plowing. Figures 36 through 39 illustrate the distribution of the Morrow Mountain, Brewerton/Otter Creek, Lackawaxen, and Calvert points in the principal excavation blocks. The 3 Morrow Mountain points had one occurrence each in Blocks 1, 5, and 6, all from subsoil contexts. The 11 Brewerton/Otter Creek points were widely dispersed, although only 2 were recovered from plowzone contexts. The Lackawaxen and Calvert points, represented by 4 examples each, were also dispersed throughout the site. Three of the Lackawaxen points and 1 of the Calvert points were recovered from plowzone contexts. Two Brewerton/Otter Creek points in Block 3 (Units 43 and 55) represent the only possible concentration within the Morrow Mountain, Brewerton/Otter Creek, Lackawaxen, and Calvert point types.

Points of the Vernon/Halifax type were the most numerous group (N = 33) in the site assemblage, and there were several clusters of this point type in Blocks 4, 5, and 6 (Figures 40, 41, and 42), some better defined than others. Apparent spatial clustering of these points may be partially attributable to their high numerical frequency in the assemblage, and historic cultivation of the site

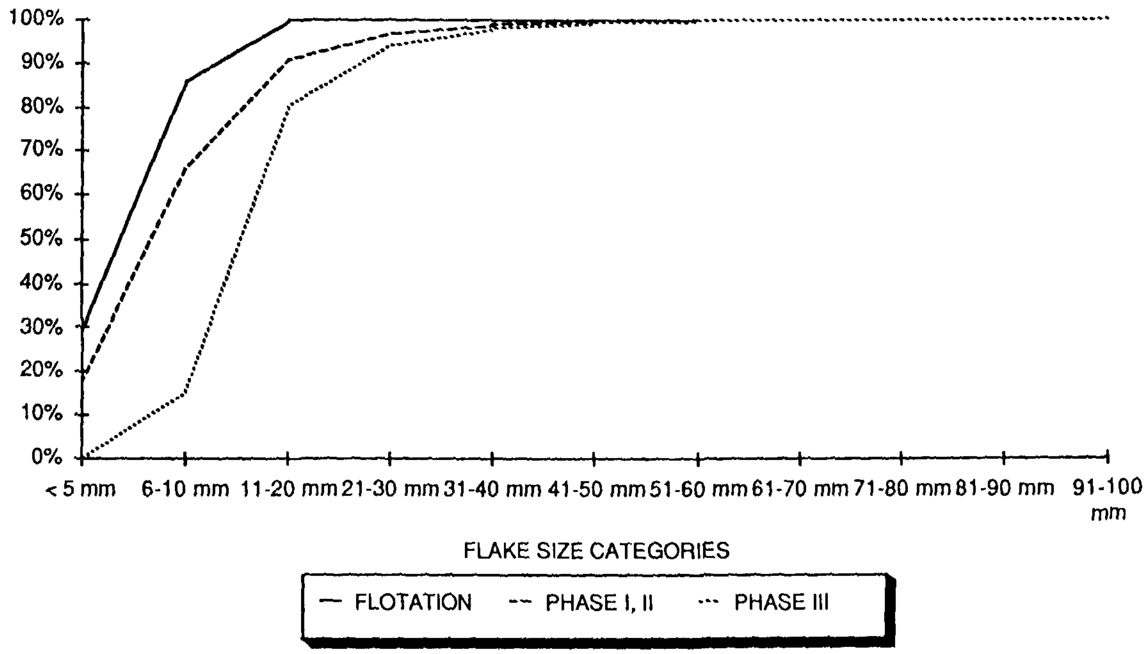


FIGURE 32: Cumulative Percentage of Flakes by Size and Recovery Method

may have dispersed some concentrations. There were two units (49 and 129) that included 3 examples and four units (65, 144, 126, and 130) with 2 examples each. The 3 Vernon/Halifax points from Unit 49 represent the principal concentration of this type in Block 4, and the single occurrences from Units 89, 90, and 116 may also be included in this cluster that broadly encompasses the eastern portion of Block 4; 2 of the points in Unit 49 were recovered from plowzone contexts. There was little apparent clustering of Vernon/Halifax points in Block 5. There were 3 points in adjacent Units 65 and 157, but 2 of these were recovered from the plowzone of Unit 65. Two points from Units 40 and 59, which are adjacent, were both from undisturbed subsoil. Block 6 contained the greatest number of Vernon/Halifax points (N = 16). Among these, 8 were included in a well-defined area in the north of the block, encompassing Units 144, 145, 149, 150, 151, 152, and 153, and all but 1 of these were from subsoil. Seven points were included in a smaller but well-defined area encompassing Units 129, 130, 131, and 134; 1 of the 7 points in this cluster was recovered from the plowzone.

The 14 Clagett points, which are believed to be stylistically and temporally related to the Vernon/Halifax points, had a dispersed or scattered distribution that was restricted to the central area of the site, with most occurrences in Blocks 4, 5, and 6 (Figures 43, 44, and 45). Only 1 of the points assigned to this type was recovered from the plowzone, indicating use of a broad area of the site by the group that used and discarded that point type. Four of the Clagett points formed a loosely defined cluster in Units 145, 147, 149, and 152) that corresponds closely to a concentration of Vernon/Halifax points in the northern portion of Block 6.

There were two clusters of Savannah River points (large variety) that include 9 of the 16 points of this type. However, only 6 of the 16 Savannah River points were recovered from subsoil contexts; therefore, their spatial clustering must be viewed with caution. The primary concentration included 5 points in the southeast portion of Block 5 (Figure 46), although 4 of the 5 points represent plowzone finds. There was a secondary cluster of 4 Savannah River points in Block 6 representing Units 146, 147, 148, and 159 (Figure 47); only 1 of this group was recovered from the plowzone.

The small Savannah River points, which are clearly distinct from the large variety by size and raw material, were also distinct in their spatial distribution. The 9 points of this type exhibited a dispersed pattern, and there were no multiple occurrences in the same or adjacent units. Only 1 of the 9 small Savannah River points was recovered from the plowzone, suggesting that the widespread distribution of these points corresponds to extensive use of the site area by the group that discarded these points.

The Holmes points are generally comparable to the large Savannah River points in terms of raw material preference, morphology, and size, and their spatial distribution (Figure 48) corresponds quite well to the Savannah River points. There are only 5 Holmes points in the entire site collection, but 4 of these were clustered in the northeast portion of Block 6 (Units 142, 146, 148, and 159), overlapping the concentration of Savannah River points. Two of the Holmes points in this area were plowzone finds.

b. Raw Materials

1) Quartz

Quartz accounts for the largest single raw material in the lithic assemblage, and it had a ubiquitous distribution throughout the site. It was recovered from all excavation units, but in amounts ranging from zero to more than 100 artifacts (tools and debitage) per 2.5x2.5-foot quadrant. Quartz was used in the manufacture of Kirk, St. Albans, LeCroy, Kanawha, Brewerton/Otter Creek, Vernon/Halifax, and Clagett points, which indicates the exploitation of local lithic sources during the Early Archaic and Late Archaic occupations. Another indication of the widespread use of quartz is its use for a broad range of artifacts, including bifaces, unifaces, modified flakes, cobble tools, cores, debitage (flakes and chunks), and fire-cracked rock. More than 80 percent of the cores recovered from the site are of quartz, and the widespread distribution of quartz cores and debitage indicates that quartz tool manufacture was one of the primary activities carried out at the site.

The distribution of quartz tools and debitage within excavation blocks is illustrated in Figures 49 through 64. Blocks 4, 5, and 6 contained the principal concentrations of tools and debitage, although a few of the scattered test units (Units 20, 25, 39 and 50) also contained high concentrations of debitage. The scattered units with high debitage concentrations were all located in the central area of the site that was sampled by Blocks 4, 5, and 6.

Blocks 1, 2, and 3 contained low to moderate concentrations of debitage, in addition to cores, early- and middle-stage bifaces, modified flakes, and biface fragments (see Figures 49, 51, and 53). These items indicate that tool manufacturing activities were carried out in those parts of the site, but at a lesser degree of intensity or frequency than in the remainder of the site. Blocks 1 and 2, where there was a gravel bar exposure, contained lithic workshop features (Features 4 and 5). The paucity of debitage in Blocks 1 and 2 suggests that production activities were limited primarily to extraction and initial testing of cobbles. A similar pattern of exploitation is suggested for Block 3, where the quartz assemblage contained low to moderate amounts of debitage, cores, biface fragments, early- and middle-stage bifaces, and one unifacial tool.

Block 4 contained two distinct concentrations of quartz debitage, and they were both in close proximity to fire-cracked rock features. Three adjacent quadrants in Units 24 and 103 contained concentrations of quartz debitage (see Figure 57), defining an activity area that appears to be associated with Feature 2. The larger concentration of quartz debitage in Block 4 was centered in the southeast quadrant of Unit 115, near Features 17 and 19. Concentrations of debitage were also recovered from adjacent quadrants in Units 49 and 72, and these may represent a separate activity area associated with Feature 12. Numerous points, cores, and incomplete and fragmentary bifaces were also recovered from Block 4 (see Figures 55 and 56). The distribution of tools partially overlaps the debitage concentrations but is somewhat distinct.

The distribution of quartz debitage in Block 5 ranged from moderate to high, but this area contained only one well-defined debitage concentration--in the southeast portion of the block, centered on the northwest quadrant of Unit 59 near Feature 10 (see Figure 60). The distribution of cores in Block 5 was more highly patterned. Eight units in this block (Units 51, 62, 63, 91, 92, 94, 98, and 157) contained 3 or more cores; four (Units 62, 63, 92, and 157) contained 5 or more cores (see Figures 58 and 59).

Block 6 contained three concentrations of quartz debitage, the largest in any of the excavation blocks. The largest of these extended through Units 33, 140, 144, 145, 149, 150, and 155, while the others extended through Units 137, 138, and 161 and Units 38 and 123 (see Figure 63). Cores were recovered from units throughout Block 6, and their distribution is well patterned. The heaviest concentration of quartz cores in the Block 6 subsoil was evident in the southeast part of the block, extending through Units 34, 117, 120, and 125 (see Figure 62). This concentration was adjacent to, yet distinct from the debitage concentration in this area. Another concentration of cores was evident in Units 137, 141, and 142, encompassing an area adjacent to the debitage concentration in Units 137 and 138; however, many of the cores in this area were recovered from plowzone contexts (see Figure 61). Cores and unfinished bifaces were also scattered throughout the remainder of Block 6, with some areas of minor concentration.

Block 7 contained sparse amounts of tools and debitage, and the only diagnostic artifact recovered from this area was a quartz Vernon/Halifax point (see Figure 64). The radiocarbon date obtained from Feature 6 is consistent with a Late Archaic use of this area.

2) Quartzite

Quartzite is the second most common material in the site's lithic assemblage, accounting for 28 percent of the total. Quartzite was used in a variety of artifact types (bifaces, unifaces, modified flakes, cobble tools, cores, debitage (flakes and chunks), and FCR. The use of quartzite was most intensive during the Late Archaic occupations, particularly during the phases represented by Clagett, large Savannah River, and Holmes points. One Kirk point was made of quartzite, indicating minor use of this material during the Early Archaic. Quartzite tools and debitage are widely distributed throughout Area 3, and each of the excavation units contained at least one piece of debitage. Figures 65 through 82 illustrate the distribution of quartzite tools and debitage throughout the principal excavation blocks.

The distribution of debitage shows a number of concentrations indicating the loci of tool manufacturing activities. Concentrations were more clearly defined in the subsoil than in the plowzone, but in some instances the debitage concentrations in the plowzone and subsoil occurred in different areas of the site. There were no concentrations of debitage in Blocks 1, 2 and 7, either in the plowzone or subsoil. The largest concentration of quartzite debitage was in Block 3, and it was evident in both the plowzone and subsoil distribution maps (see Figures 70 and 71). This concentration was centered in Unit 56, but it also extended to the northwest quadrant of Unit 68 in the subsoil. Block 4 contained a single debitage concentration in the plowzone, centered in Unit 89, but the subsoil quadrants of this unit contained only a moderate amount of debitage. The largest plowzone concentration was in Block 5, extending across Units 51, 65, and 67 (see Figure 75), but the subsoil quadrants in these units contained only low to moderate amounts of material. An isolated unit 10 feet to the west of this area (Unit 50) also contained a concentration of debitage in its plowzone, and this may represent an extension of the plowzone concentration in Units 51, 65, and 67. The only subsoil concentration in Block 5 was in the northwest quadrant of Unit 40, but the overlying subsoil contained only a moderate amount of material (see Figures 81 and 82). Block 6 contained the second largest subsoil concentration of quartzite debitage, although the overlying plowzone contained only moderate amounts of material. The subsoil concentration was centered on Unit 127 and extended into the northeast quadrant of Unit 126, adjacent to Features 21 and 24. The southwest quadrant of Unit 130 also contained a concentration, possibly representing an extension of the material in Units 126 and 127. Quartzite debitage concentrations were also evident in a number of isolated excavation units; these include the plowzones of Units 26, 41, 43, and 50, and subsoil quadrants in Units 22 and 26.

In general, the quartzite tool distributions do not overlap the debitage, i.e., large numbers of tools were not found within concentrations of debitage. Instead, most tools were found in units adjacent to those containing FCR features, especially in Blocks 1, 4, 5, and 6. Blocks 1 and 2, which were centered on lithic workshop areas (Features 4 and 5), both contained low to moderate amounts of debitage but distinctly different quartzite tool assemblages (see Figures 65 and 67). Both contained 2 points each, but they differ in the inclusion of a scraper and two utilized flakes in Block 1 and hammerstones and incomplete bifaces in Block 2. The hammers and incomplete bifaces in Block 2 are indicative of primary tool production activities, while the scraper and utilized flakes are indicative of processing tasks. The two blocks are also distinguished by the inclusion of FCR features in Block 2 and their absence from Block 1.

The Block 3 quartzite assemblage is indicative primarily of tool manufacturing activities. In addition to the largest concentration of debitage, this area contained 4 cores, 2 incomplete bifaces, 3 biface fragments, and 2 utilized flakes (see Figure 69). Although diagnostic quartzite points were recovered from this block, a number of Late Archaic points of other material were recovered.

The overall distribution of tools in Block 4 appears to exhibit two concentrations adjacent to Feature 2 and the cluster of FCR features (12, 17 and 19) in the northeast portion of the block.

Unfinished bifaces and utilized flakes were widely scattered in this block. All 3 points were recovered from the western part of the block, and the 2 cores, 4 hammerstones, and 7 biface fragments were recovered from the eastern part of the block (see Figure 72).

The quartzite tool distributions in Block 5 exhibit a degree of concentration in areas adjacent to the FCR features (see Figures 75 and 76). Excavation in Block 5 yielded 6 large Savannah River points, of which 5 were from plowzone contexts (Figure 46). Among these, 4 were from units in the southeast sector that contained Features 7, 8, 9, and 10. Cores, hammerstones, biface fragments, a utilized flake, and a Clagett point were recovered from the southwest sector of Block 5, which contained Features 11, 13, and 14. The northwest sector contained a variety of tools, including four Late Archaic points, 4 utilized flakes, 2 unfinished bifaces, 4 biface fragments, and 1 core; Feature 18 was the only FCR cluster in this area.

Block 6 contained the densest concentration of quartzite tools, and the overall distribution exhibits the greatest number of tools in units adjacent to those containing FCR features. Feature 29, the cache of unfinished quartzite bifaces, was identified in the northwest sector of Block 6, and the surrounding units contained additional unfinished bifaces, biface fragments, and cores (see Figure 80). The site's second largest concentration of quartzite debitage was located to the south of Feature 29, extending through Units 126, 127, and 129 (see Figure 82); this area and the immediately adjacent units also contained cores, unfinished bifaces, hammerstones, utilized flakes, and points. The only Early Archaic point made of quartzite was recovered from the extreme southeast sector of Block 6, an area that also contained a number of artifacts associated with primary lithic production: hammerstones, unfinished bifaces, and biface fragments.

The quartzite tool assemblage from Block 7 was limited to a Clagett point and a metate, both recovered from Unit 60.

3) Rhyolite

Rhyolite was the most common nonlocal material used at the site, representing 17.5 percent of the chipped-stone assemblage. Rhyolite was used during both the Early Archaic and Late Archaic occupations; it is well represented in the Palmer/Kirk and bifurcated-base point clusters as well as in all Late Archaic points with the exception of the large Savannah River points. In addition to its occurrence as debitage, rhyolite is represented in the biface, uniface, modified flake, and core artifact categories, and these tools were widely scattered over the site, although Excavation Blocks 2, 3, 4, 5, and 6 contained the majority of the rhyolite tools and debitage. Figures 83 through 95 illustrate the distribution of rhyolite tools and debitage according to the plowzone and contexts of the principal excavation blocks.

There were seven concentrations of rhyolite debitage that represent tool manufacturing or refinishing areas. The largest and most concentrated of these was located in the center of Block 6, adjacent to Feature 3. Other concentrations of rhyolite debitage were located in Unit 155 (Block 6), Unit 52 (Block 5), Unit 68 (Block 6), Units 99 and 100 (Block 5), Unit 68 (Block 3), and Unit 20 (isolated unit).

Block 2 contained 4 rhyolite points, including 1 Kanawha point, 1 Brewerton/Otter Creek point, and 2 untyped specimens (see Figure 83). Debitage in this block included only a light to moderate scatter in the eastern side (see Figure 84). Block 3 contained 2 Brewerton/Otter Creek points in addition to 1 untyped point and 6 biface fragments (see Figure 85). There was also a well-defined concentration of debitage in this block, centered on the southeast quadrant of Unit 68 (see Figure 86).

In Block 4, rhyolite tools and debitage were concentrated primarily in the eastern area, indicating that tool manufacturing and discard activities centered around Features 12, 17 and 19 (see Figures

87, 88, and 89). With the exception of one small Savannah River point, all of the diagnostic rhyolite points in Block 4 date from the site's Early Archaic occupation. Other rhyolite tools in this area included 1 drill, 1 core, 2 utilized flakes, 1 middle-stage biface, and 11 biface fragments. Although there were no concentrations of rhyolite debitage in Block 4, there was a light to moderate scatter of flakes and chunks that corresponds to the distribution of the tools and features.

Block 5 contained three distinct concentrations of rhyolite debitage, indicating the presence of three loci related to tool manufacture or rejuvenation (see Figure 92). The rhyolite tools in this block, particularly those recovered from subsoil contexts, exhibited a similar distribution, as they were concentrated in the northern, southwestern, and southeastern areas (see Figure 91). Diagnostic points recovered from Block 5 indicate use of this area during the Early Archaic and Late Archaic occupation. Two of the Early Archaic rhyolite points were clustered in the southeast sector (Unit 57), near Feature 10 and within an area of low to moderate debitage concentration. The third Early Archaic point was located in the northern end of the block (Unit 99) and within a concentration of debitage. Late Archaic points recovered from Block 5 include 1 Clagett, 1 Lackawaxen, 1 Morrow Mountain, and 1 small Savannah River point, all of which were from the southern portion of the block. Other rhyolite tools from this block include 4 untyped points, 1 core, 1 late-stage biface, 4 middle-stage bifaces, and 13 biface fragments. The concentration of 4 middle-stage bifaces and 7 biface fragments in the southeastern sector of Block 5 may represent an additional tool manufacturing locus.

Block 6 exhibited the highest overall concentration of rhyolite tools and debitage within the site (see Figures 93, 94 and 95), and the distribution of diagnostic points indicates that this area of the site was used repeatedly during the Early Archaic and Late Archaic periods. In addition to points representing the Kirk, Kanawha, Stanly, Vernon/Halifax, Brewerton/Otter Creek, Calvert, and small Savannah River types, 11 untyped rhyolite points were recovered from this block. Other tools include 1 drill, 4 modified flakes, 4 cores, and 22 biface fragments.

4) Sandy Chert

Sandy chert is the second most common nonlocal material, accounting for 5 percent of the chipped-stone assemblage. It exhibits distinctive patterns of use, as seen in its spatial distribution and use for particular artifact types. Tools made of sandy chert include 4 bifaces and 1 modified flake, and these account for only 0.2 percent of the material, a much lower proportion than any other raw material. The remainder includes 3 cores and 1,920 flakes and chunks. The only diagnostic artifact made of sandy chert is a Morrow Mountain point, which dates to the Late Archaic. The distribution of sandy chert exhibits the highest degree of spatial patterning of any raw material, suggesting that use of this material was limited to a single occupational phase.

Sandy chert was concentrated in the southeast area of Block 5 and the northeast corner of Block 6, as shown in Figures 96 through 99. All of the tools and roughly 95 percent of the debitage occurred within this area. The remainder of the sandy chert debitage consisted of a very light scatter in Blocks 1, 3, and 4 and in a few isolated units. There were two very well-defined debitage concentrations within Blocks 5 and 6. The highest debitage concentration was in the northeast corner of Block 6, covering portions of Units 148, 154, 159, and 160. This area also included 2 of the 3 cores and 1 early-stage biface; the Morrow Mountain point was recovered at the periphery of this area. A secondary concentration of sandy chert occurred within the southeast corner of Block 5, centered on Unit 64. The remainder of the sandy chert tools--1 core, 1 modified flake and 2 biface fragments--were recovered from units surrounding this concentration.

5) Chert

Chert accounts for only 0.4 percent of the chipped-stone assemblage, but it is represented in a fairly wide range of artifact classes, including bifaces, unifaces, modified flakes, cores, and debitage (chunks and flakes). Bifaces account for a relatively high proportion of this material, which is the typical pattern of use for nonlocal materials. Diagnostic bifaces made of chert include 2 points in the Palmer/Kirk group and 1 in the bifurcated-base group, indicating that use of this material was restricted to the Early Archaic occupation of the site. Chert tools and debitage were widely scattered throughout the site, but most concentrated in Blocks 5, 6, and 7, as shown in Figures 100 through 107. One Palmer/Kirk point was recovered from the plowzone of Unit 88 (Block 2) and the other was recovered from Unit 156 (Block 5). The chert LeCroy point was recovered from Unit 50, an isolated unit between Blocks 4 and 5. The chert debitage exhibited a wide distribution and no apparent concentration, as no unit contained more than 5 pieces of debitage. Unit 32 contained the highest number of flakes, and this concentration may be associated with the Palmer point in the plowzone of Unit 88. The 3 chert scrapers recovered from Units 51 and 156 in Block 5 appear to be associated with the Kirk/Palmer point recovered from Unit 156 (see Figure 102). Chert cores were most concentrated in the central portion of Block 6 (see Figure 106) and in Block 7, where there was also a light scatter of debitage. Fairly continuous scatters of debitage were evident in the eastern portion of Block 4 (see Figure 101) and the southern portion of Block 6 (see Figure 105); both of these areas also contained Early Archaic points made from materials other than chert.

6) Chalcedony

Chalcedony accounts for a minor fraction of the chipped-stone assemblage (0.4 %), and it is represented by 6 bifaces, 2 modified flakes, 1 core, and debitage. The culturally diagnostic bifaces include one projectile point each of the Holmes, small Savannah River, and Lackawaxen point types, indicating that use of this material was limited to the Late Archaic occupational phases. The distribution of chalcedony is also fairly well defined spatially, as nearly all of the material was recovered from the southern portion of Block 5 and the northern portion of Block 6 (Figures 108 through 111). Although chalcedony accounts for a minor fraction of the total debitage assemblage, there were two well-defined concentrations in Block 5 (see Figure 109). The primary concentration included portions of Units 52 and 54, and a secondary concentration was included in Unit 40. Unit 160, located in the northeast corner of Block 6, may have sampled the periphery of a third concentration of chalcedony debitage. For the most part, the chalcedony tools appear to have been distributed over areas contiguous to the debitage; however, many of the chalcedony tools were recovered from plowzone contexts.

7) Jasper

Jasper accounts for only 0.2 percent of the chipped stone assemblage, and this material is represented only by 2 biface fragments and 34 pieces of debitage (flakes and chunks). Although there are no culturally diagnostic artifacts made of jasper, its low frequency and restricted spatial distribution suggest that it was limited to a single occupational phase or episode. The 2 biface fragments represent widely separated contexts: 1 was recovered from the plowzone of Unit 150, located in the northern portion of Block 6, and the other was recovered from subsoil in Unit 47, an isolated unit 75 feet west of Block 6. Block 6 contained 95 percent of the jasper debitage, mostly from a concentration adjacent to Feature 3 (Figure 112).

8) Argillite

Argillite accounts for a minor proportion (0.1 %) of the chipped-stone assemblage, and its representation among the artifact classes indicates that activities were limited to tool rejuvenation and rehafting. Bifaces account for a relatively high amount of this material (3 of 37 items, or 8 %), and none of the debitage exhibits cortex. The one culturally diagnostic artifact made of argillite is a Vernon/Halifax point, indicating that use of this material occurred during the Late Archaic period. This point was recovered from Unit 66, in the quadrant adjacent to Feature 13, and the two biface fragments were recovered from Units 149 (Block 6) and 156 (Block 5). Whereas the argillite tools were found within a relatively restricted area encompassing the southwest portion of Block 5 and the northwest portion of Block 6, argillite debitage was scattered over a much wider area. The distributional patterning of argillite debitage may be characterized as extensive and diffused, as there were no units that contained more than two pieces.

C. SUMMARY

Analysis of the lithic distribution patterning has permitted recognition of a number of discrete activity areas within the site. The presence of activity areas in association with features is notable in itself, given the historic cultivation of the surface horizon and the loose, sandy soils that are easily displaced by natural turbation processes. While much patterning is apparent within the site, it is also evident that there was a great deal of overlapping of activity areas associated with individual occupational episodes, and there was no discernible stratigraphic separation between deposits associated with different periods or phases of occupation.

The internal site patterning is evident from various perspectives. First, there were many examples of individual point types and debitage concentrations in locations immediately adjacent to FCR features, indicating that these cooking areas were the focal points for activities within the primary habitation area. Also, the clustering of diagnostic point types indicates that in many cases individual occupational phases or episodes occurred within fairly restricted areas of the site. The Early Archaic occupations, represented by points of the Palmer/Kirk and bifurcated-base point clusters were concentrated within the eastern portion of Block 4, Block 5, and Block 6, and the proximity of the Palmer/Kirk and the bifurcated-base points indicates that the Early Archaic occupational episodes generally occurred within the same areas of the site.

Judging from the number and spatial distribution of discarded points, use of the site during the Late Archaic was much more intense than during the Early Archaic. Late Archaic points are more numerous in the assemblage and they were discarded throughout Area 3, covering a much larger area than that of the Early Archaic points. The degree to which individual Late Archaic point types exhibit spatial patterning is not uniform. Many of the Late Archaic points were dispersed throughout the site, including the Morrow Mountain, Brewerton/Otter Creek, Lackawaxen, Calvert, Clagett, and small Savannah River types. Others, such as the large Savannah River, Holmes, and Vernon/Halifax were more concentrated, although apparent concentrations of the latter type may simply reflect the high frequency of that type. At a general level, the spatial dispersal of the Late Archaic points throughout the site is distinct from the clustering of the Early Archaic points, and it suggests occupation by a group composed of several distinct social units, such as households or extended families.

Activity areas within the site are most apparent in the concentrations of debitage and clusters of tools. Locally available lithic materials, particularly quartz and quartzite, exhibit a ubiquitous distribution, and they were exploited during both Early and Late Archaic occupations. There are a number of distinct activity areas associated with locally available lithic materials, and these are indicative of distinctive behavioral patterns related to lithic procurement and manufacturing activities, in addition to more generalized processing tasks. Quartz and quartzite cobbles would have been available in the creek's active channel, located more than 1,500 feet from the site, but the gravel bar exposure at the northern margin of Area 3 provided an on-site source of lithic raw material. Concentrations of cores and hammerstones in Blocks 1 and 2 indicate that the initial extraction and testing of cobbles was carried out at the gravel bar area. After suitable cores were identified, they were reduced and shaped into tools in other areas of the site.

The numerous concentrations of quartz and quartzite debitage throughout the site represent areas where biface reduction activities were carried out or the loci for redeposited refuse. Many concentrations of debitage were found adjacent to cooking areas, indicated by the FCR features, suggesting that at least some stages of the biface reduction sequence were carried out within the site's primary habitation area.

The staging and spatial separation of the reduction of local lithic material are most clearly evident in the distribution of quartzite tools and debitage. The full production sequence is represented at the site, including the extraction and initial testing of cobbles and the reduction of cores into finished bifacial implements. Cobbles were extracted and tested at the gravel bar at the northern margin of the site, sampled by Blocks 1 and 2. Feature 29, a cache of unfinished (early-stage, middle-stage and late-stage) quartzite bifaces was located within the site's primary habitation area (Block 6). The largest concentration of quartzite debitage was found in Block 3, located at the western margin of the site and apparently isolated from the primary cooking and habitation areas that were sampled by Blocks 4, 5, and 6. Biface reduction activities in the Block 3 locus are apparent from the large amount of debitage in that area, but production sequence was not completed in that locus. The isolation of the largest concentration of quartzite refuse suggests a concern for cleanliness within the habitation area, which in turn refocuses attention on the issue of refuse disposal behavior. While the isolation of the largest concentration of quartzite refuse implies concern with maintenance of a clean habitation area, it is not certain whether the debitage concentration in Block 3 represents redeposited or in situ refuse. The large amounts of lithic debitage within the primary habitation area, however, clearly indicate that the concern for cleanliness did not approach fastidiousness. Although analysis of the assemblage has not been carried out at a level that would permit a thorough examination of this issue, a few of the lithic crossmends do suggest that redeposition of refuse may have occurred within the site (see Chapter V and Table 5); however, none of the crossmends involved quartzite artifacts recovered from Block 3.

The distributional patterning of nonlocal lithic material is in some cases clearer than that of locally available material, perhaps because the assemblage contains less nonlocal material and its use was in some cases limited to single occupational episodes or phases. Rhyolite, the most common nonlocal lithic material in the assemblage, was used during both the Early and Late Archaic occupations. The initial procurement of rhyolite did not occur at the site, but the entire biface reduction is represented by cores, middle- and late-stage bifaces, biface fragments, and debitage. Rhyolite debitage was most concentrated in the site's primary habitation area (Blocks 5 and 6), and the locations of several discrete debitage concentrations suggests that tool production or rejuvenation were among the activities conducted in the central living area.

The distribution of sandy chert is the most spatially well defined of any material in the assemblage. This material may have been deposited during a single occupational episode, judging from its restricted spatial distribution and its use in a single diagnostic point. The sandy chert debitage was concentrated in the northeast corner of Block 6, adjacent to but not overlapping the site's principal concentration of fire-cracked rock features.

Other nonlocal materials (chert, jasper, chalcedony, and argillite) account for only a minor fraction of the total assemblage, and their use was probably limited to relatively few occupational episodes or single phases. In some cases where spatial patterning of these materials was apparent, concentrations of tools and debitage were identified adjacent to FCR features. Examples include a concentration of jasper adjacent to Feature 3 (Block 6) and a concentration of chalcedony adjacent to Features 7, 8, and 9 (Block 5). These examples suggest that tool maintenance activities were carried out adjacent to cooking areas within the site's central habitation area.

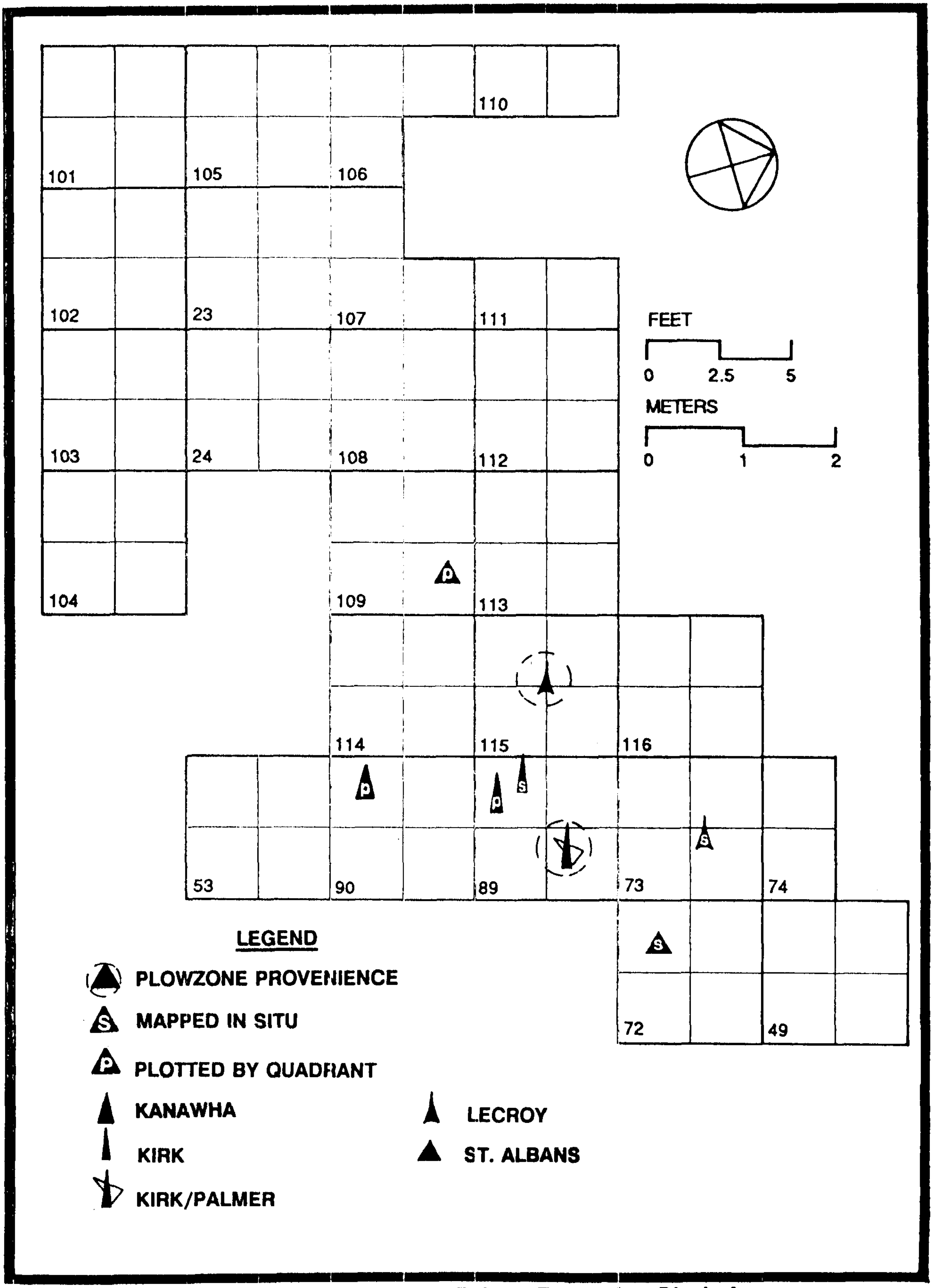


FIGURE 33: Distribution of Early Archaic Points, Excavation Block 4

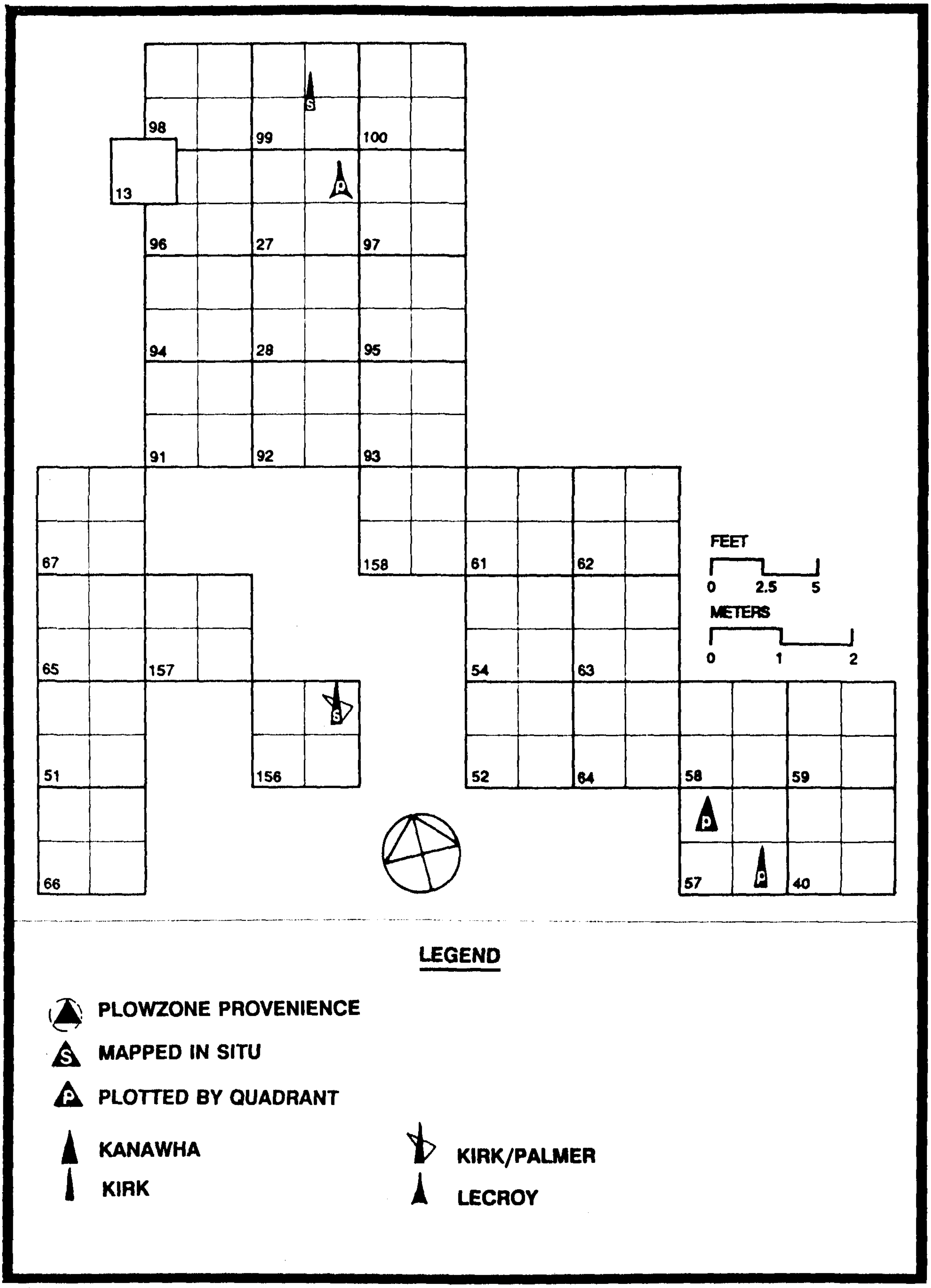


FIGURE 34: Distribution of Early Archaic Points, Excavation Block 5

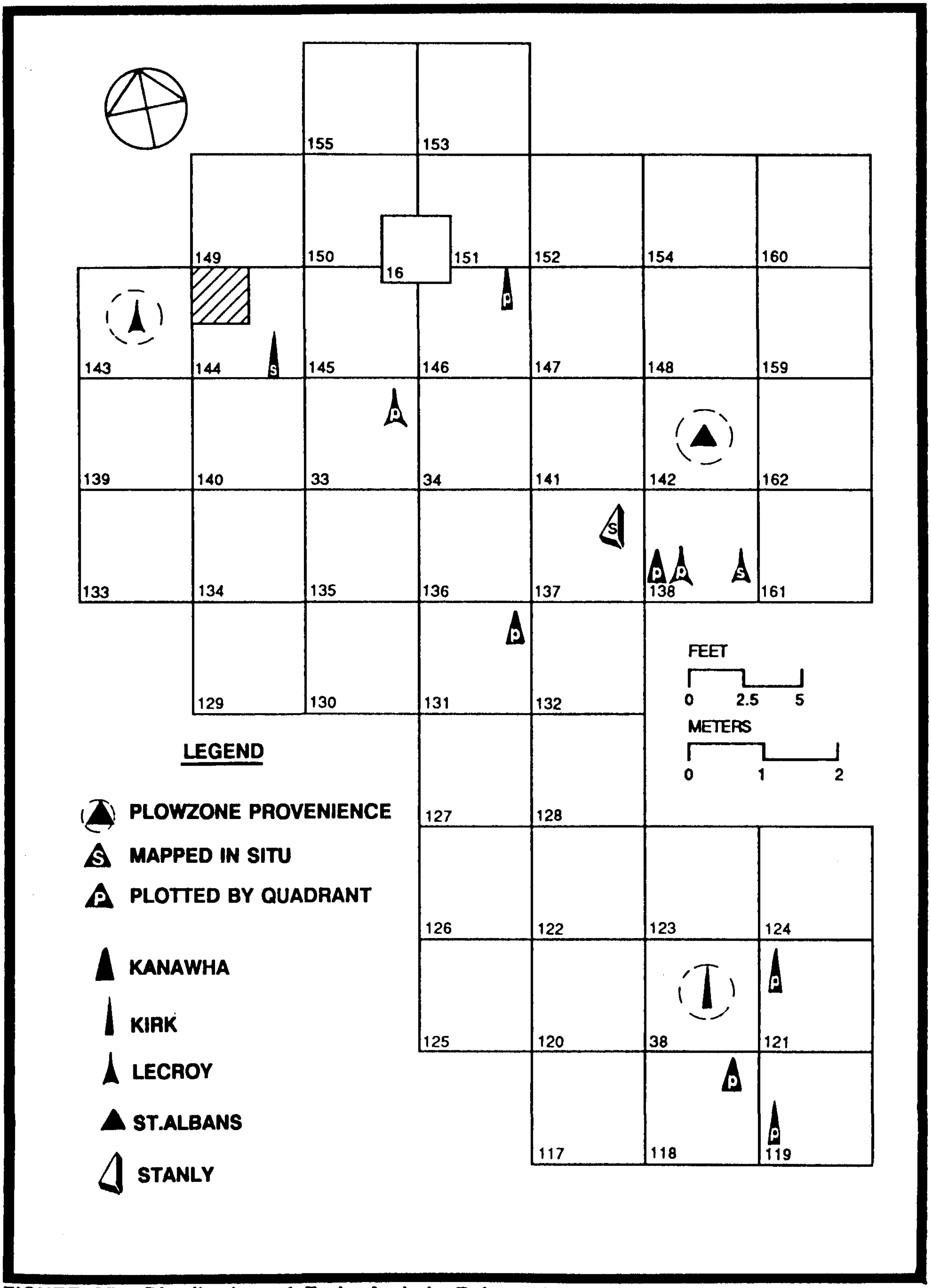


FIGURE 35: Distribution of Early Archaic Points, Excavation Block 6

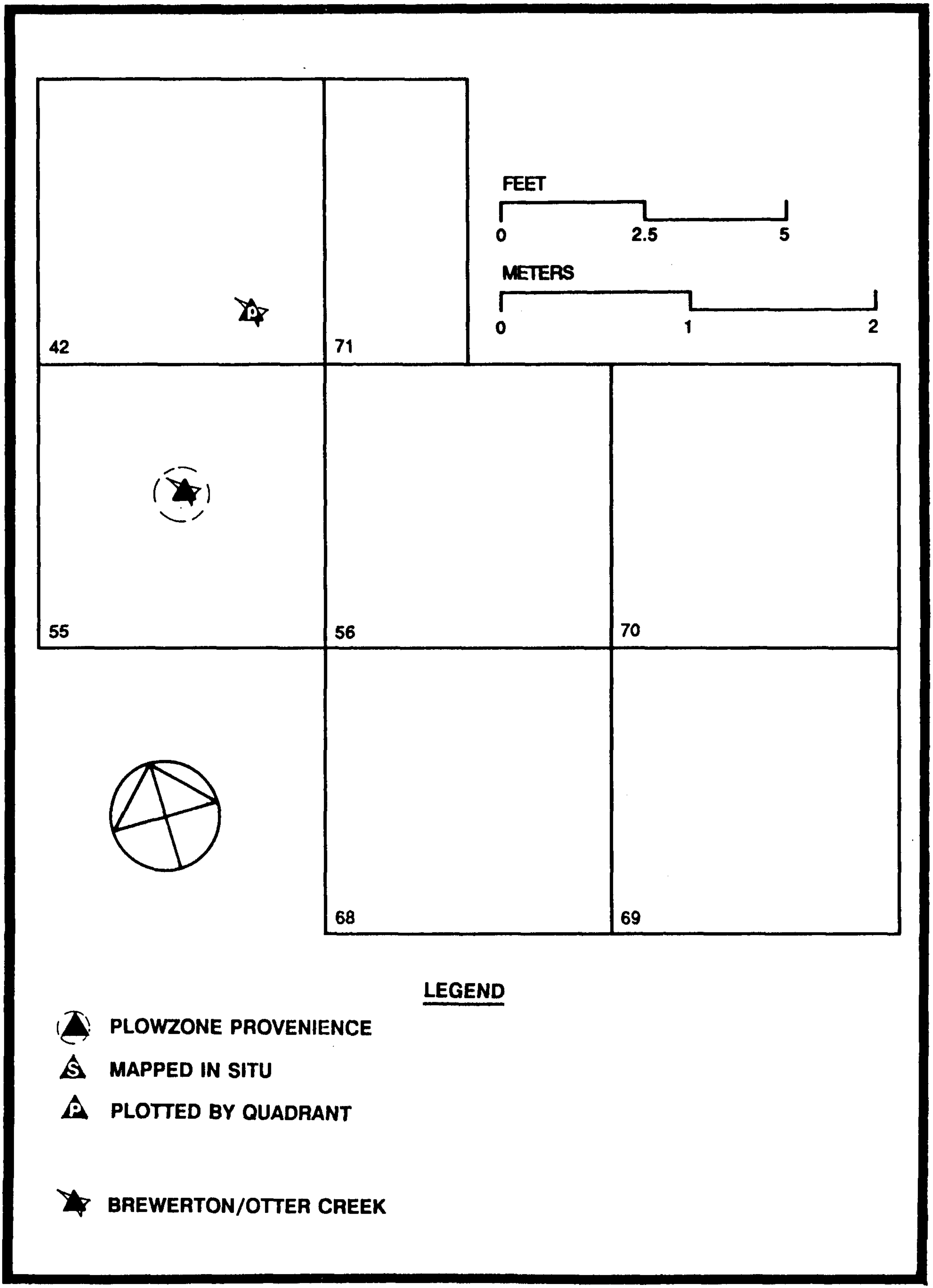


FIGURE 36: Distribution of Miscellaneous Late Archaic Points, Excavation Block 3

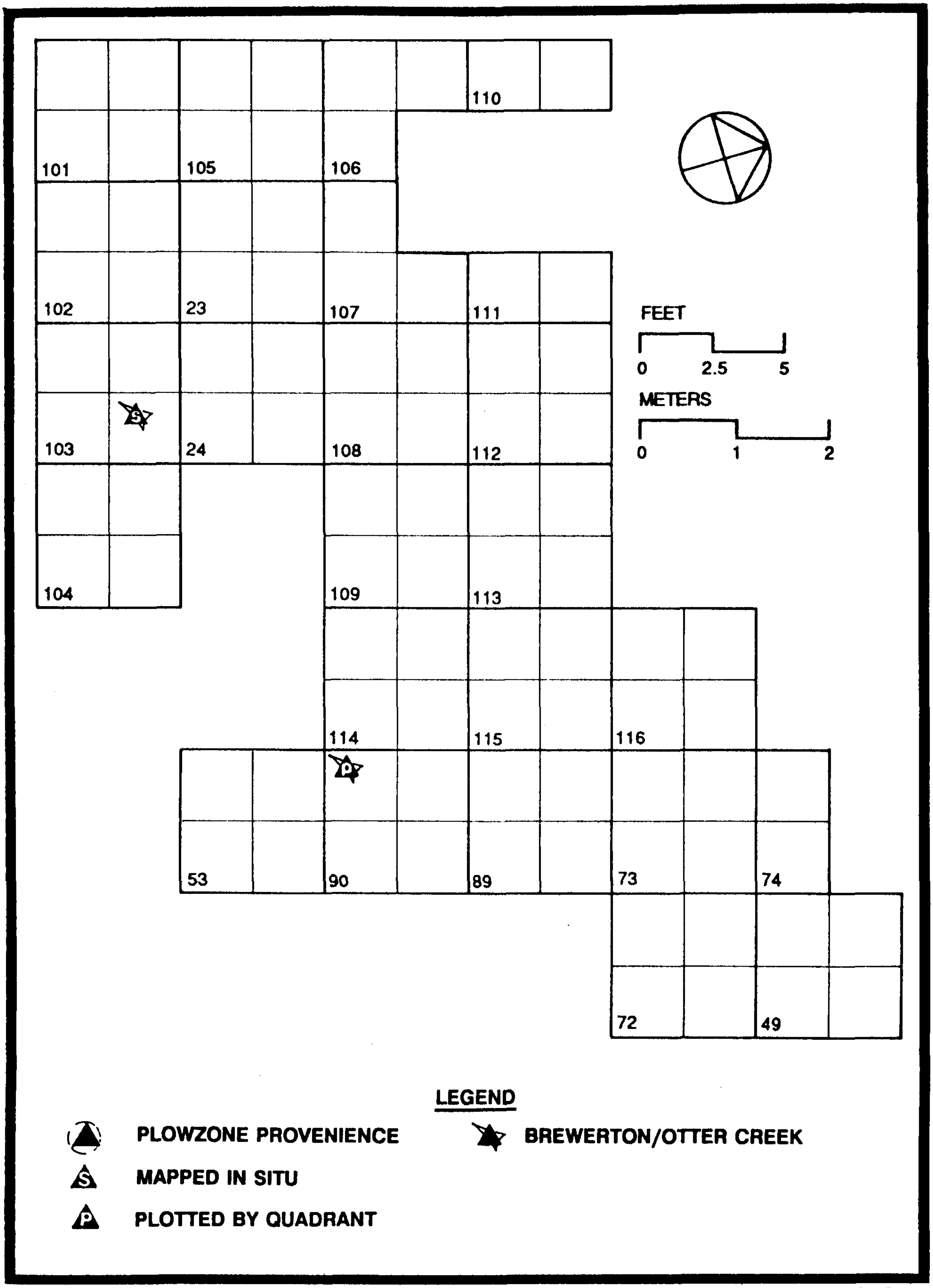


FIGURE 37: Distribution of Miscellaneous Late Archaic Points, Excavation Block 4

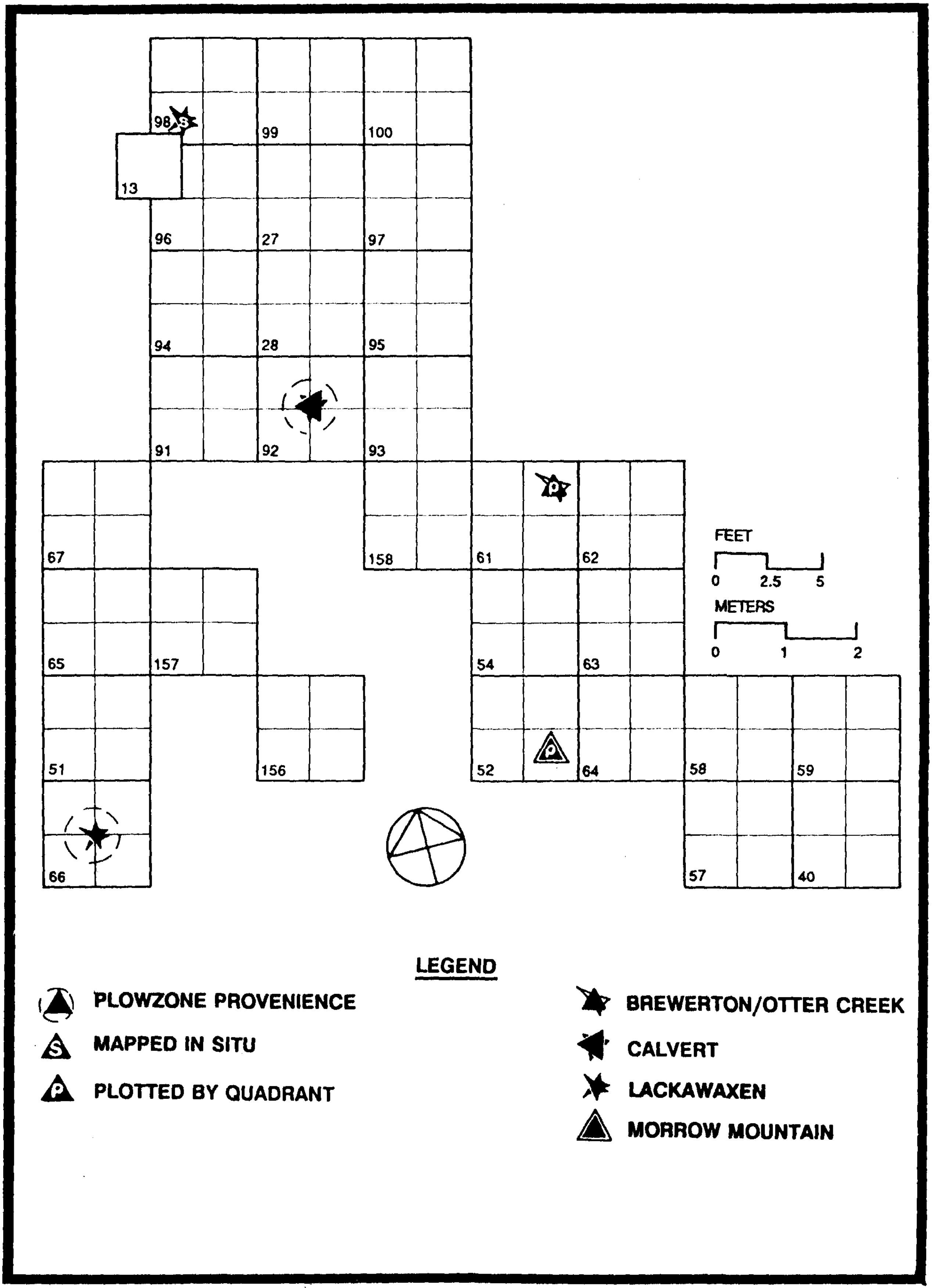


FIGURE 38: Distribution of Miscellaneous Late Archaic Points, Excavation Block 5

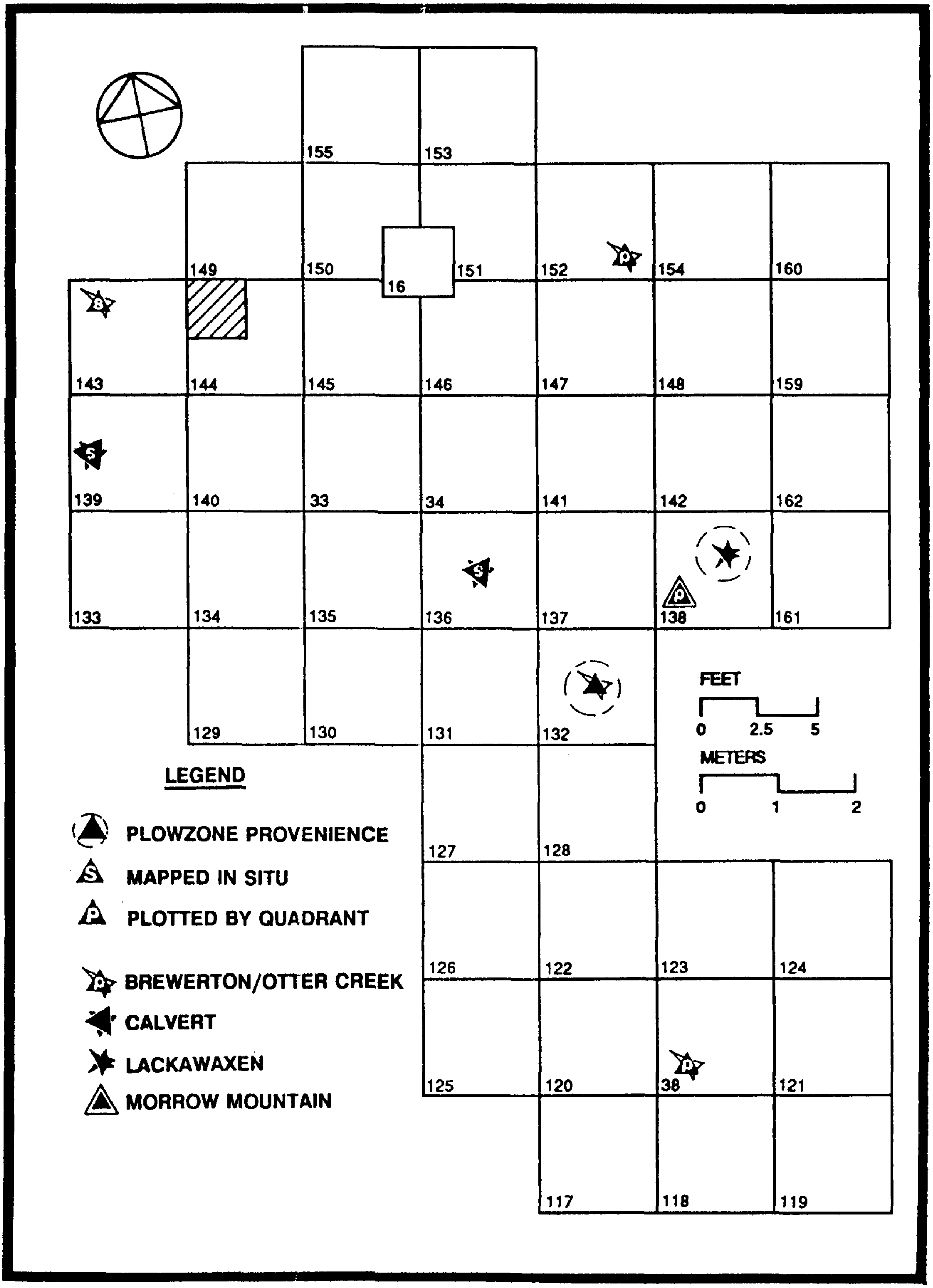


FIGURE 39: Distribution of Miscellaneous Late Archaic Points, Excavation Block 6

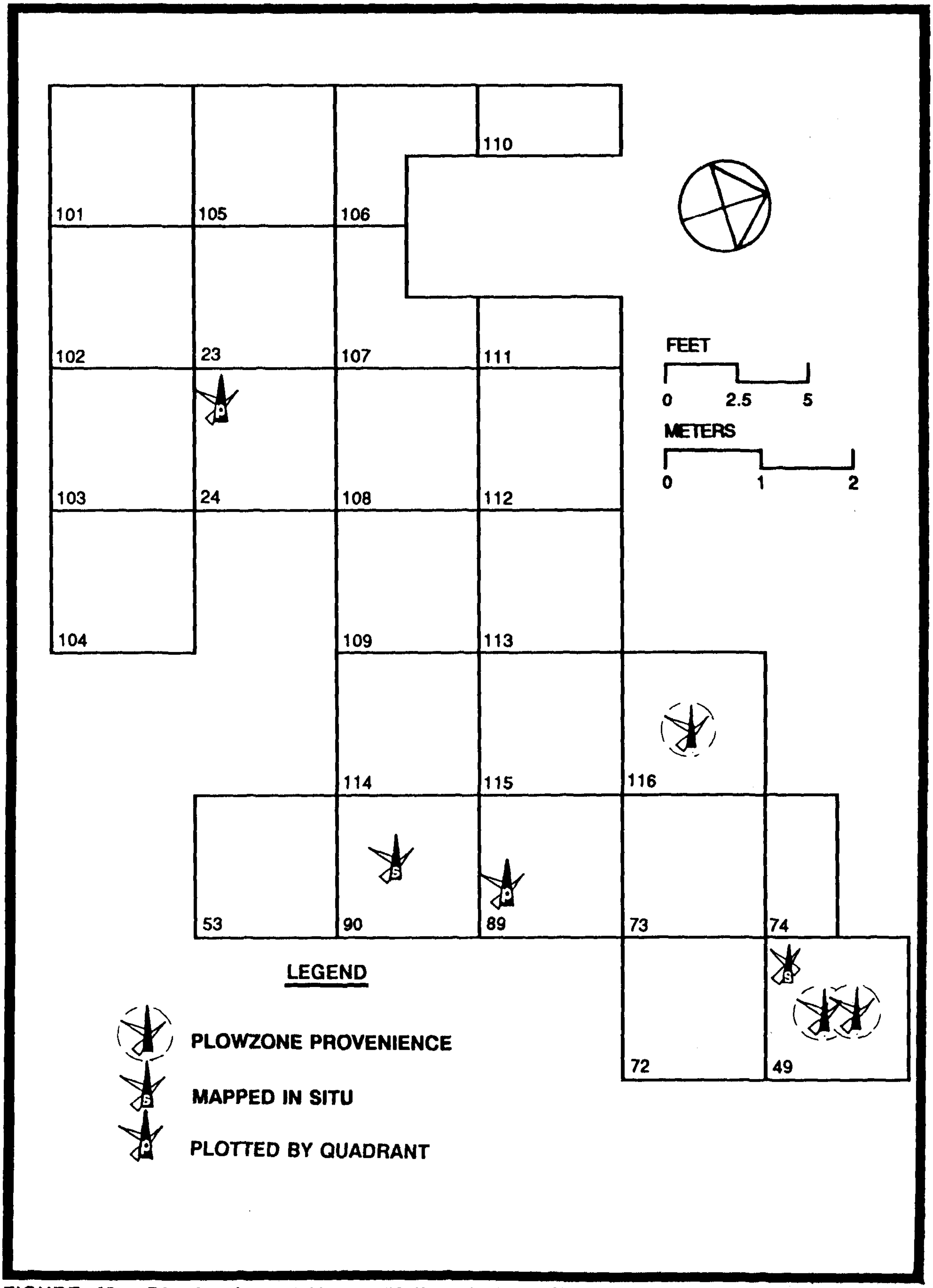


FIGURE 40: Distribution of Vernon/Halifax Points, Excavation Block 4

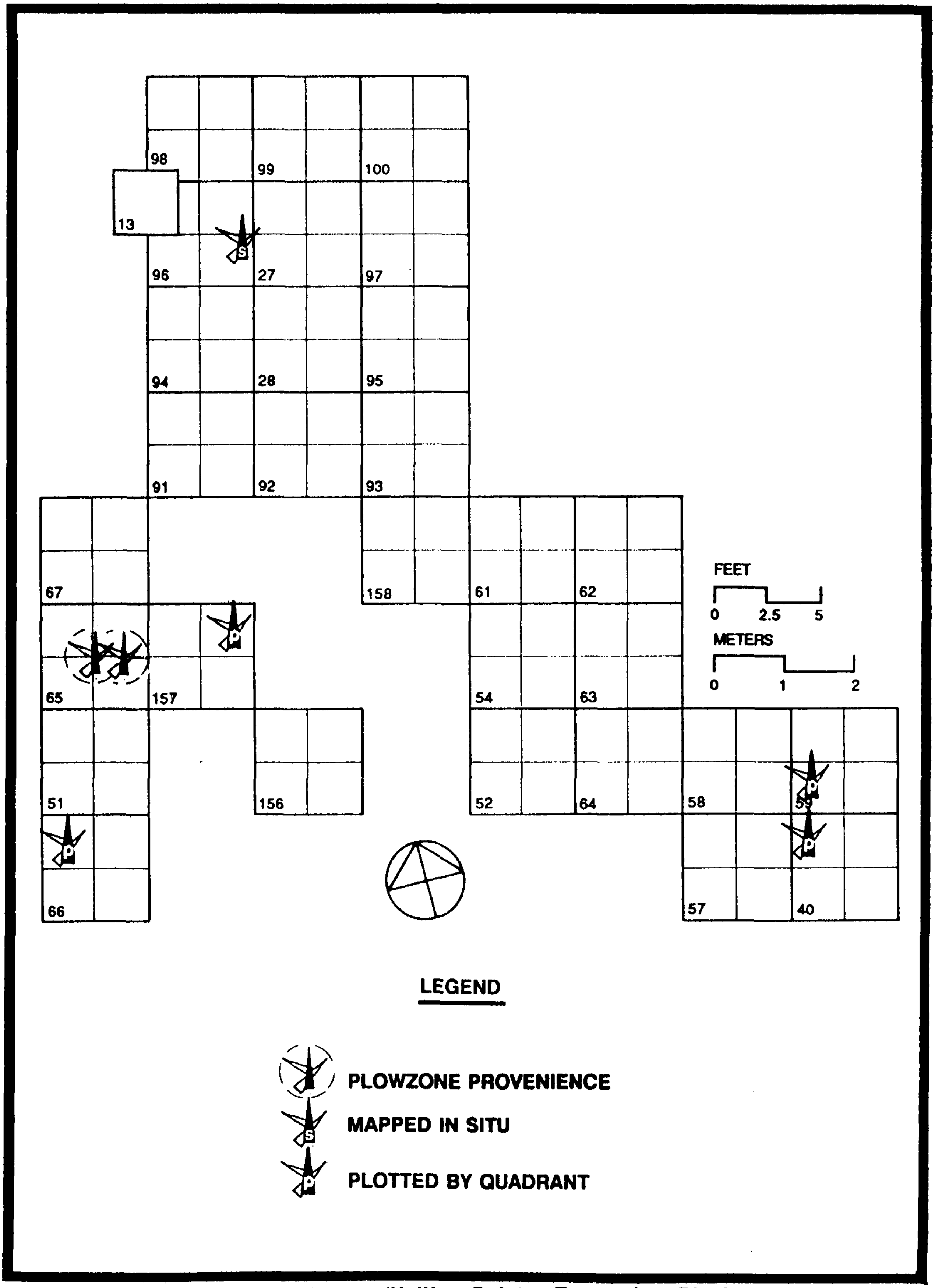


FIGURE 41: Distribution of Vernon/Halifax Points, Excavation Block 5

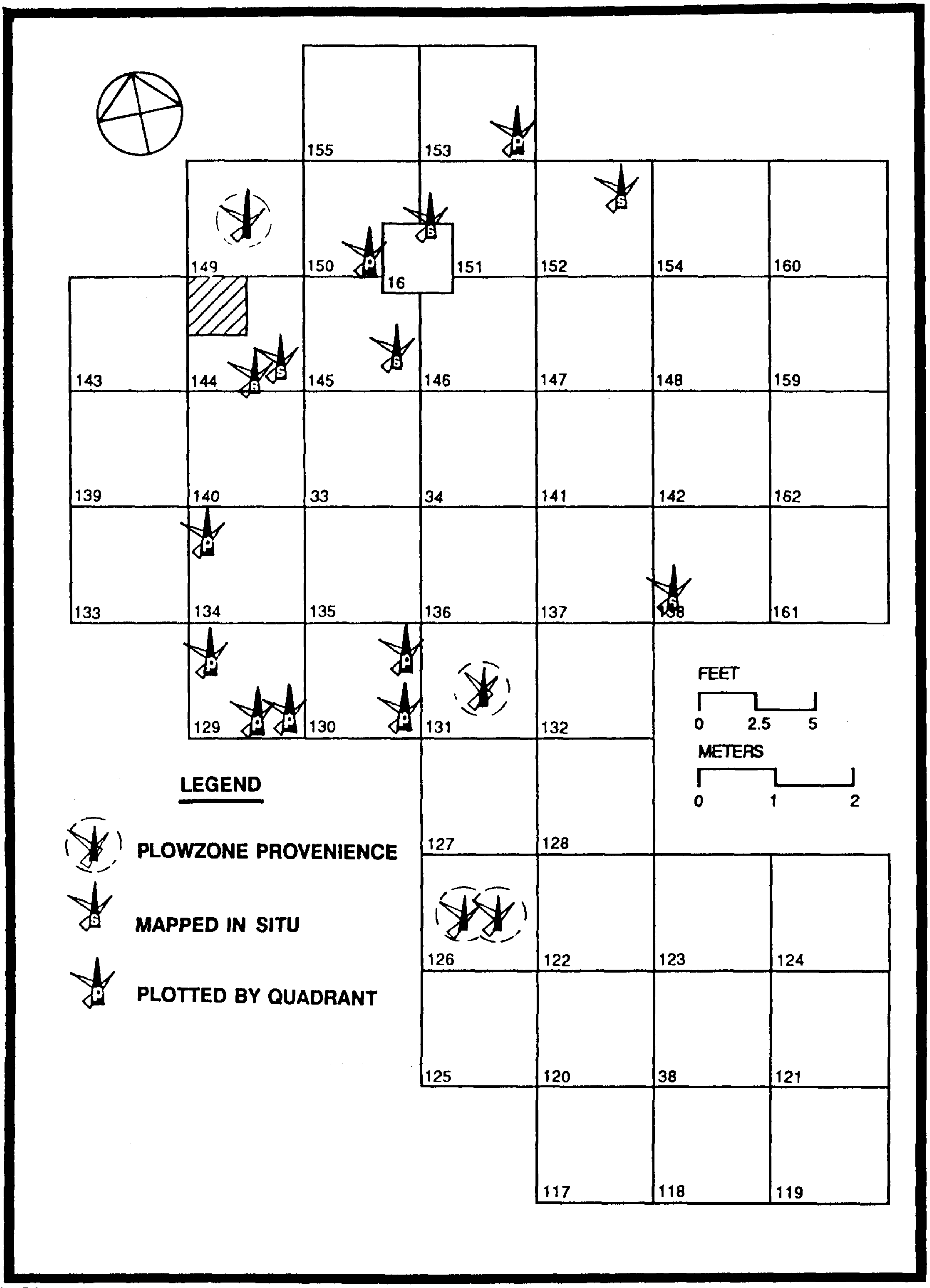


FIGURE 42: Distribution of Vernon/Halifax Points, Excavation Block 6

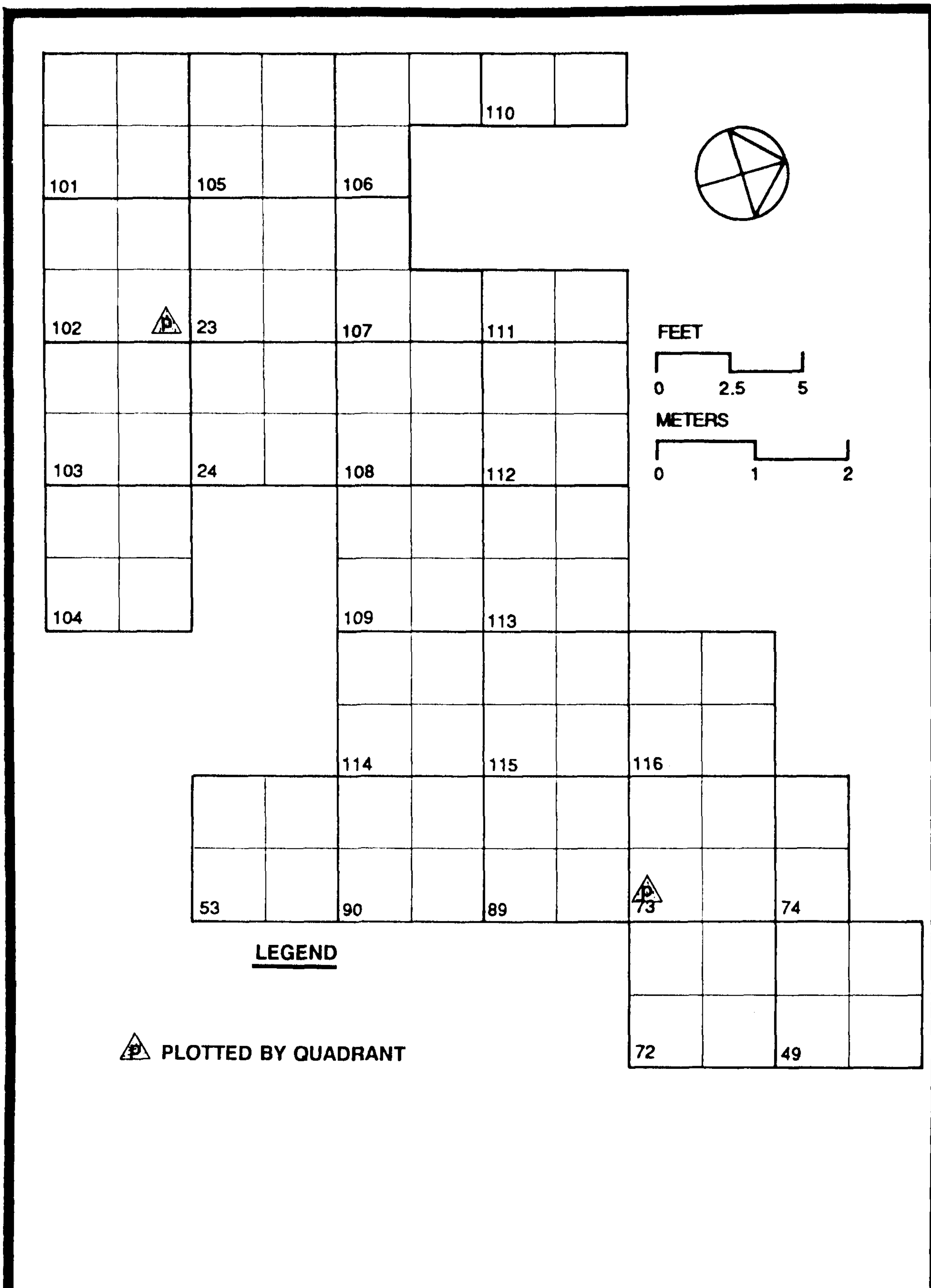


FIGURE 43: Distribution of Clagett Points, Excavation Block 4

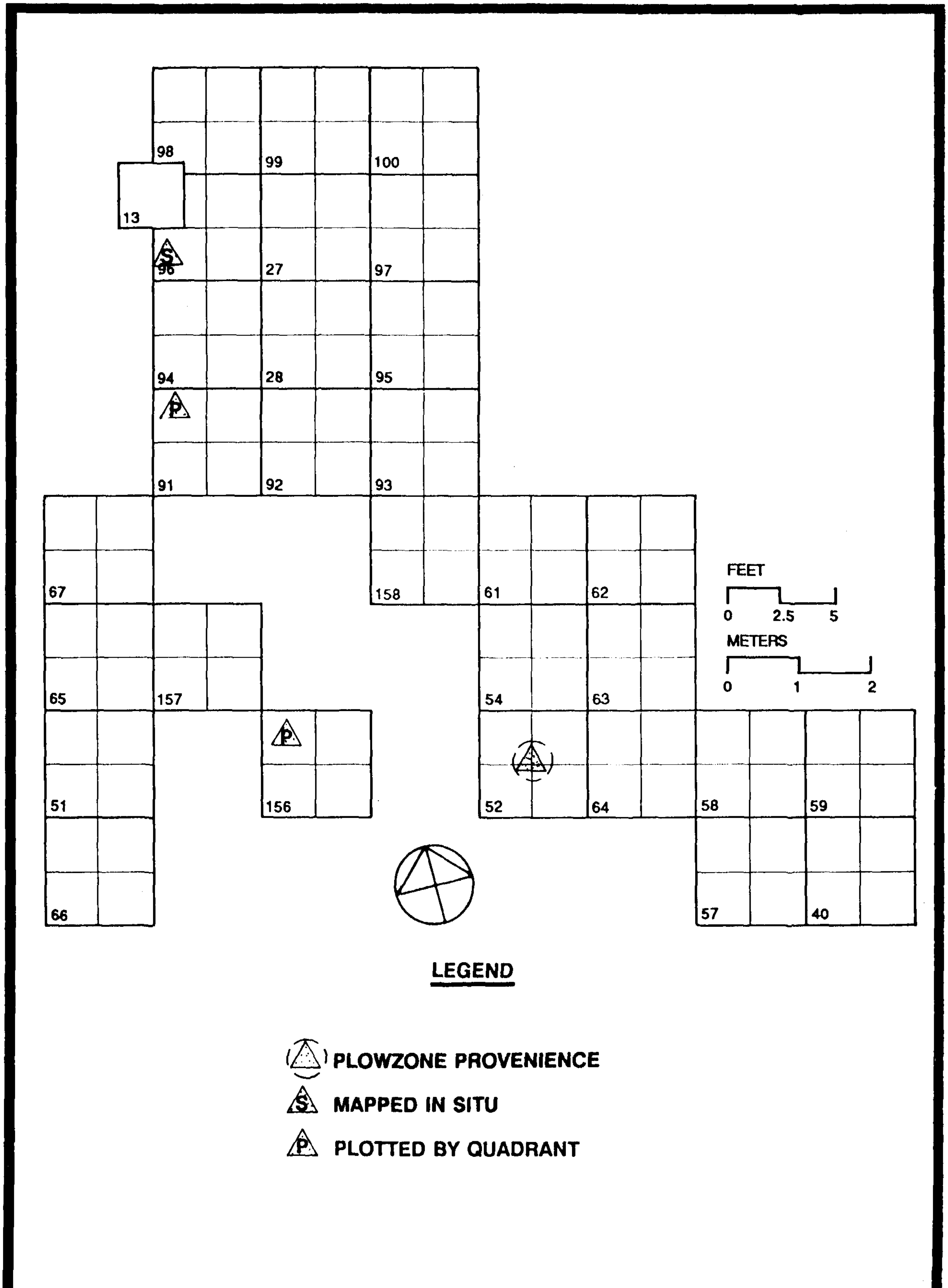


FIGURE 44: Distribution of Clagett Points, Excavation Block 5

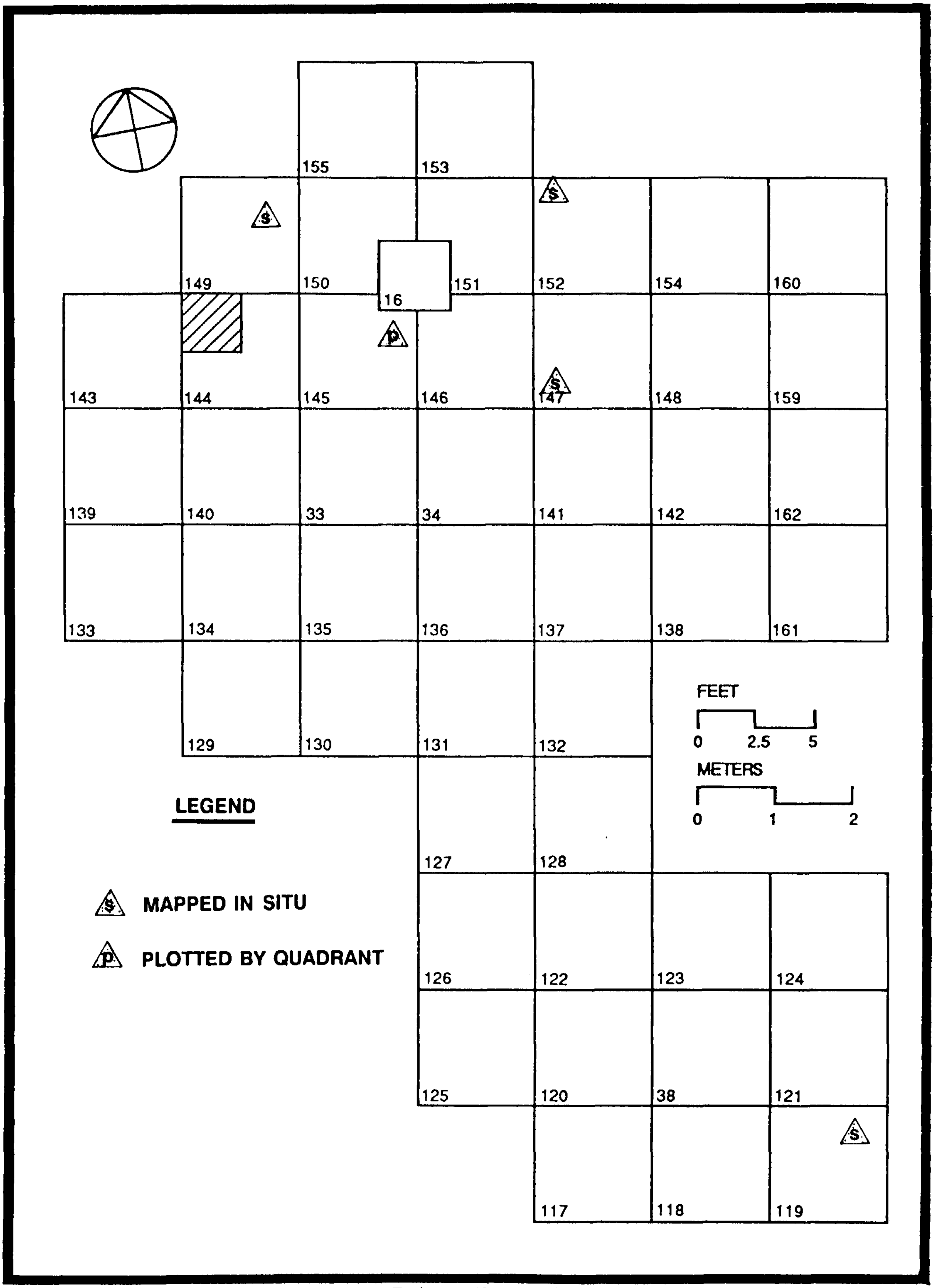


FIGURE 45: Distribution of Clagett Points, Excavation Block 6

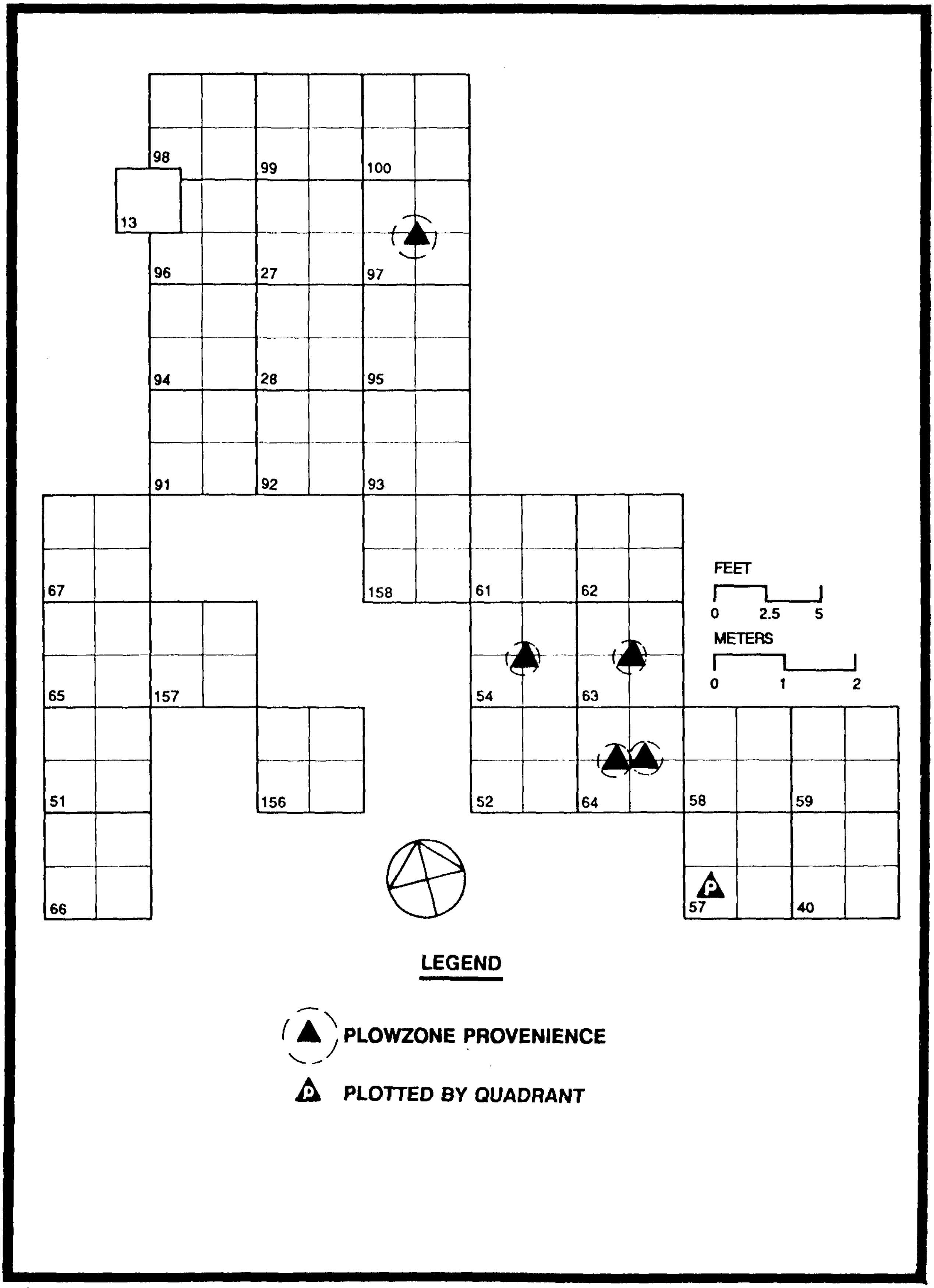


FIGURE 46: Distribution of Savannah River (large) Points, Excavation Block 5

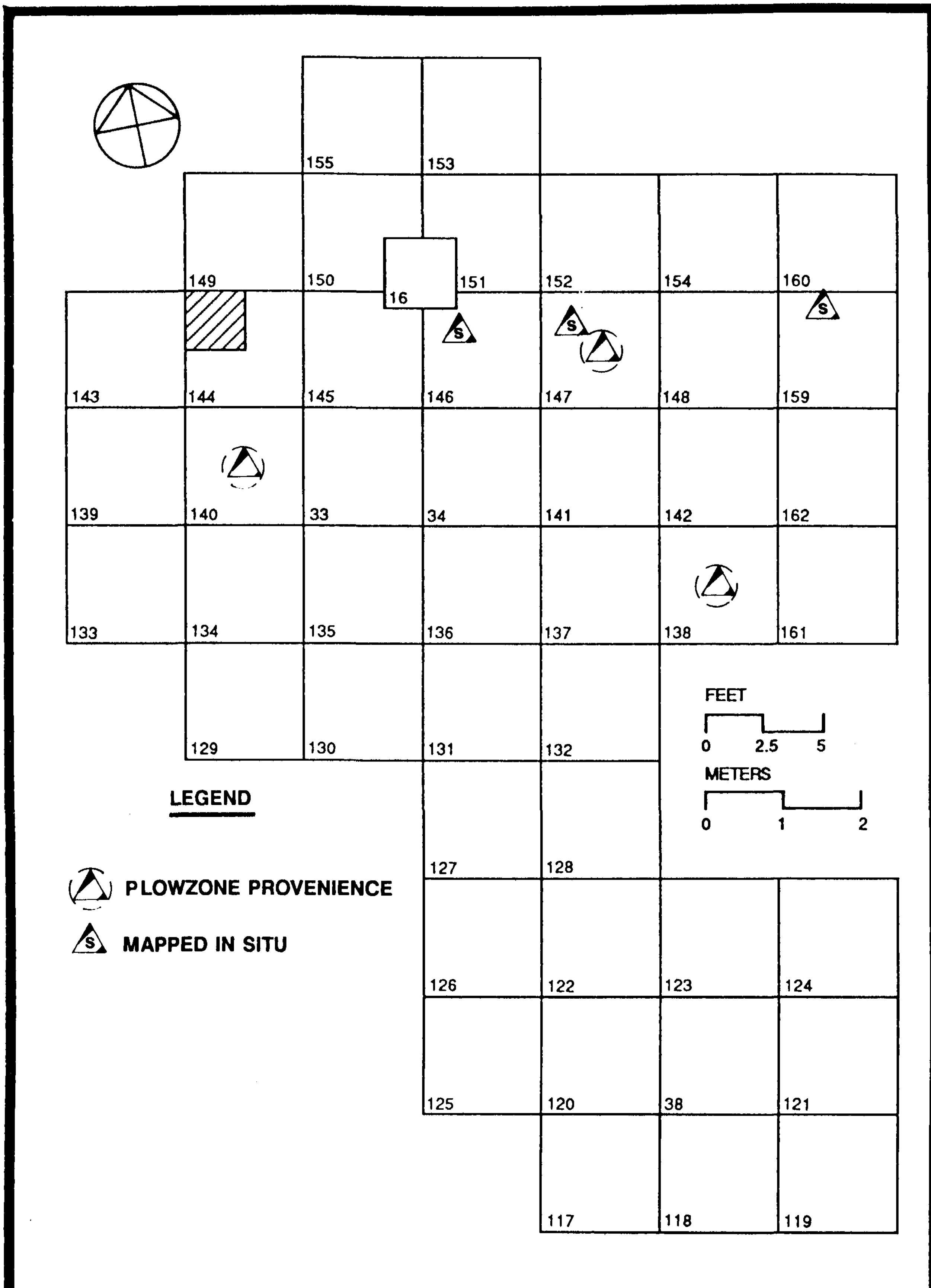


FIGURE 47: Distribution of Savannah River (large) Points, Excavation Block 6

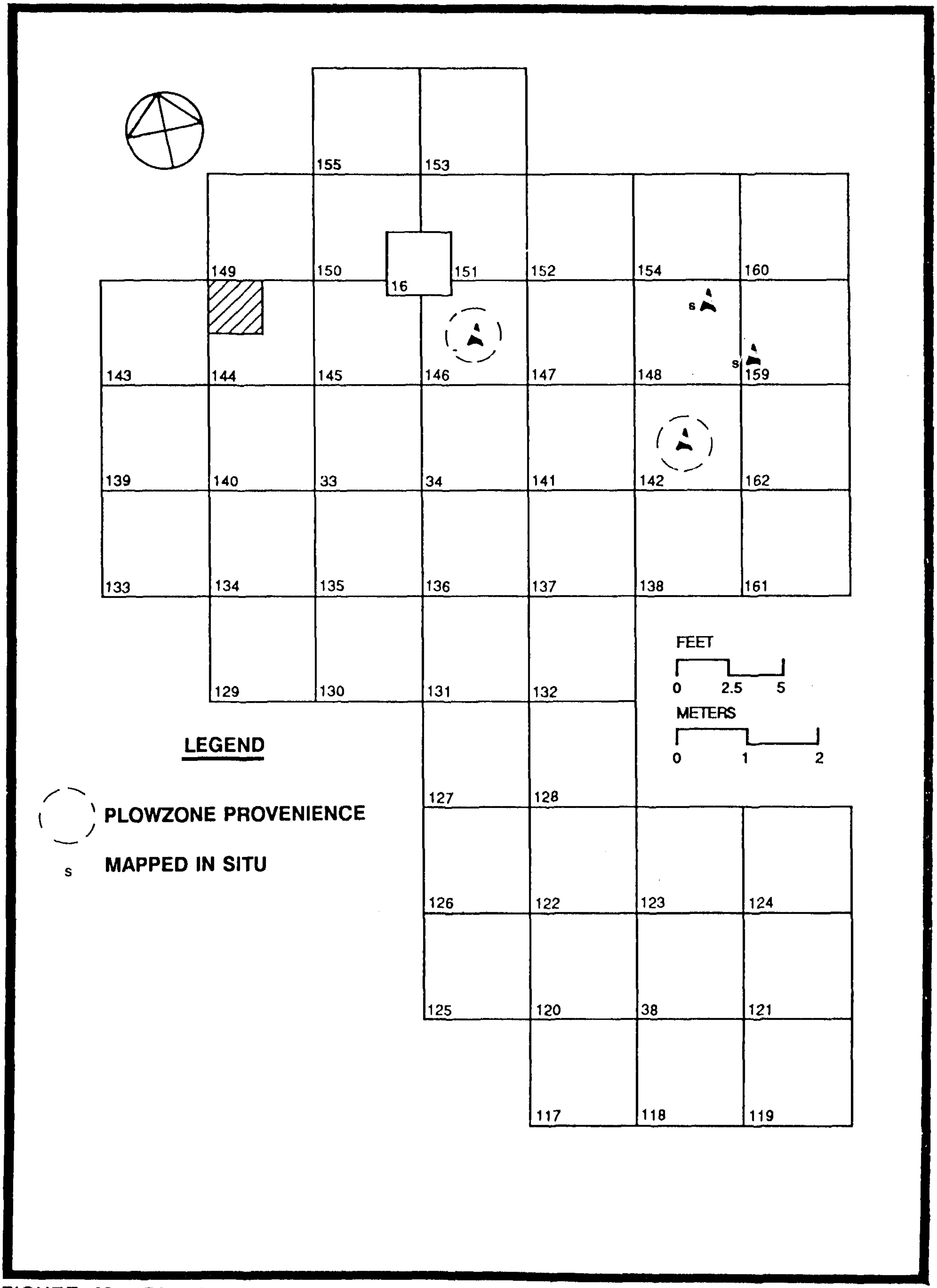


FIGURE 48: Distribution of Holmes Points, Excavation Block 6

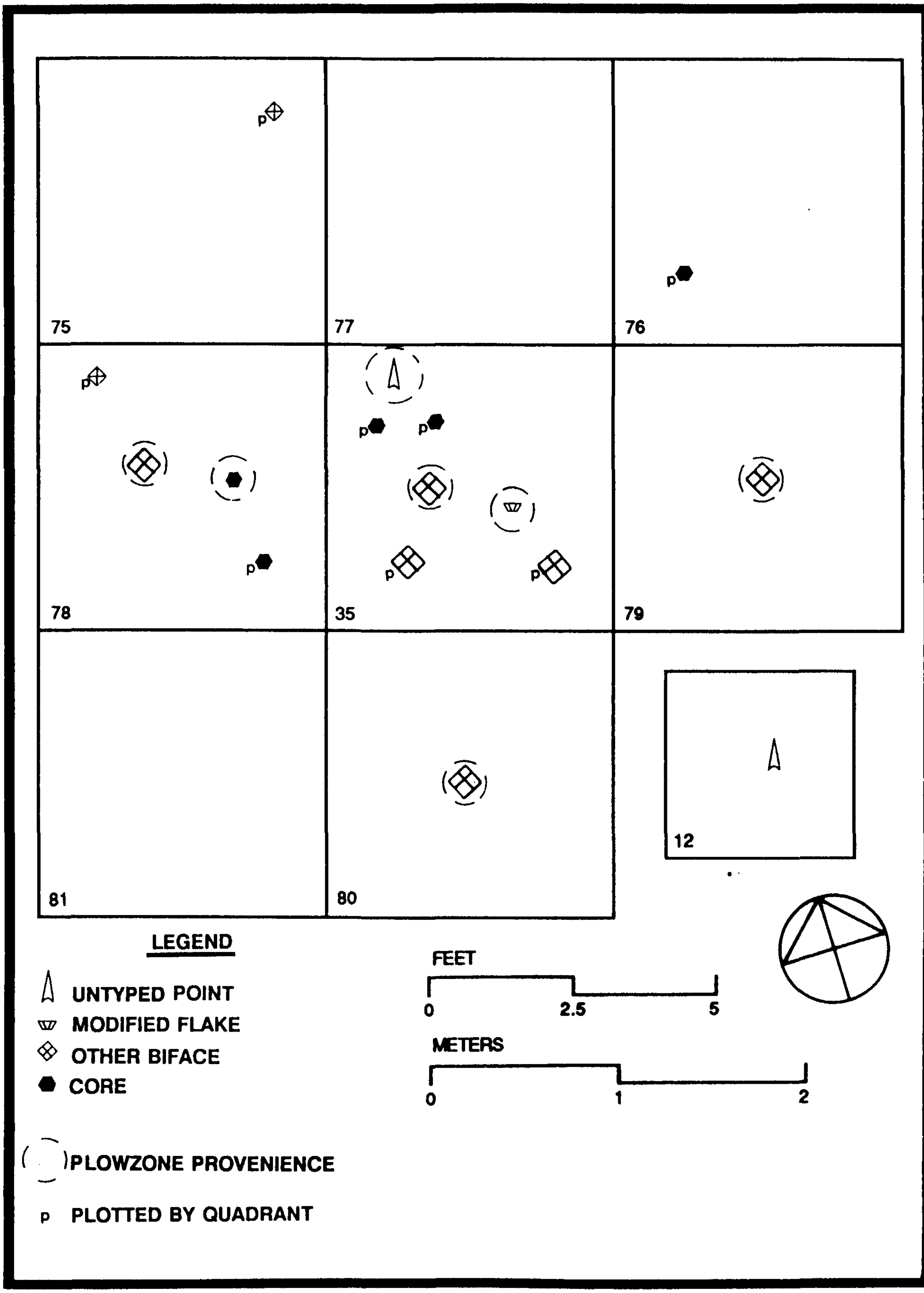


FIGURE 49: Distribution of Quartz Tools, Excavation Block 1

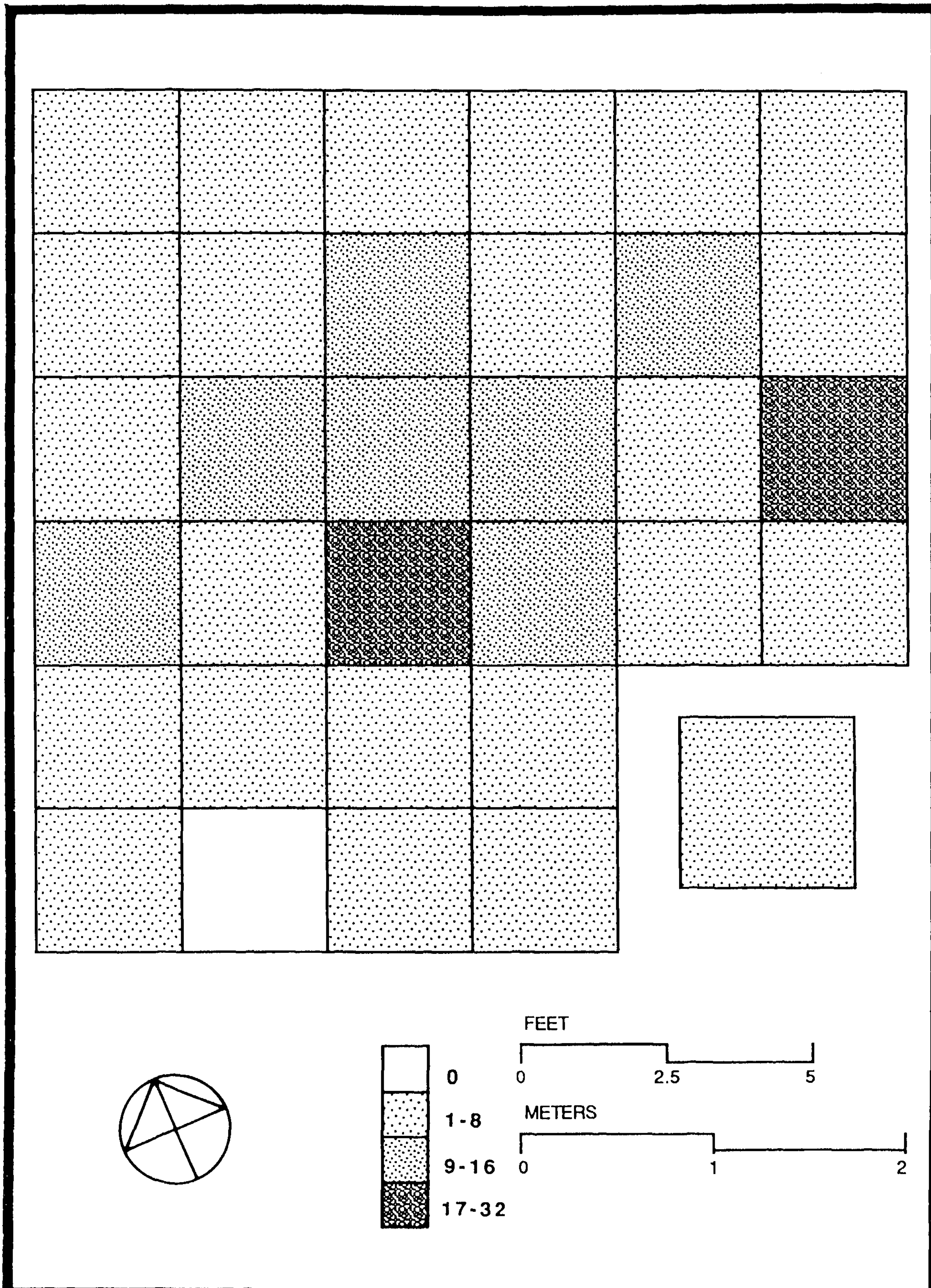


FIGURE 50: Distribution of Quartz Debitage, Excavation Block 1 Subsoil

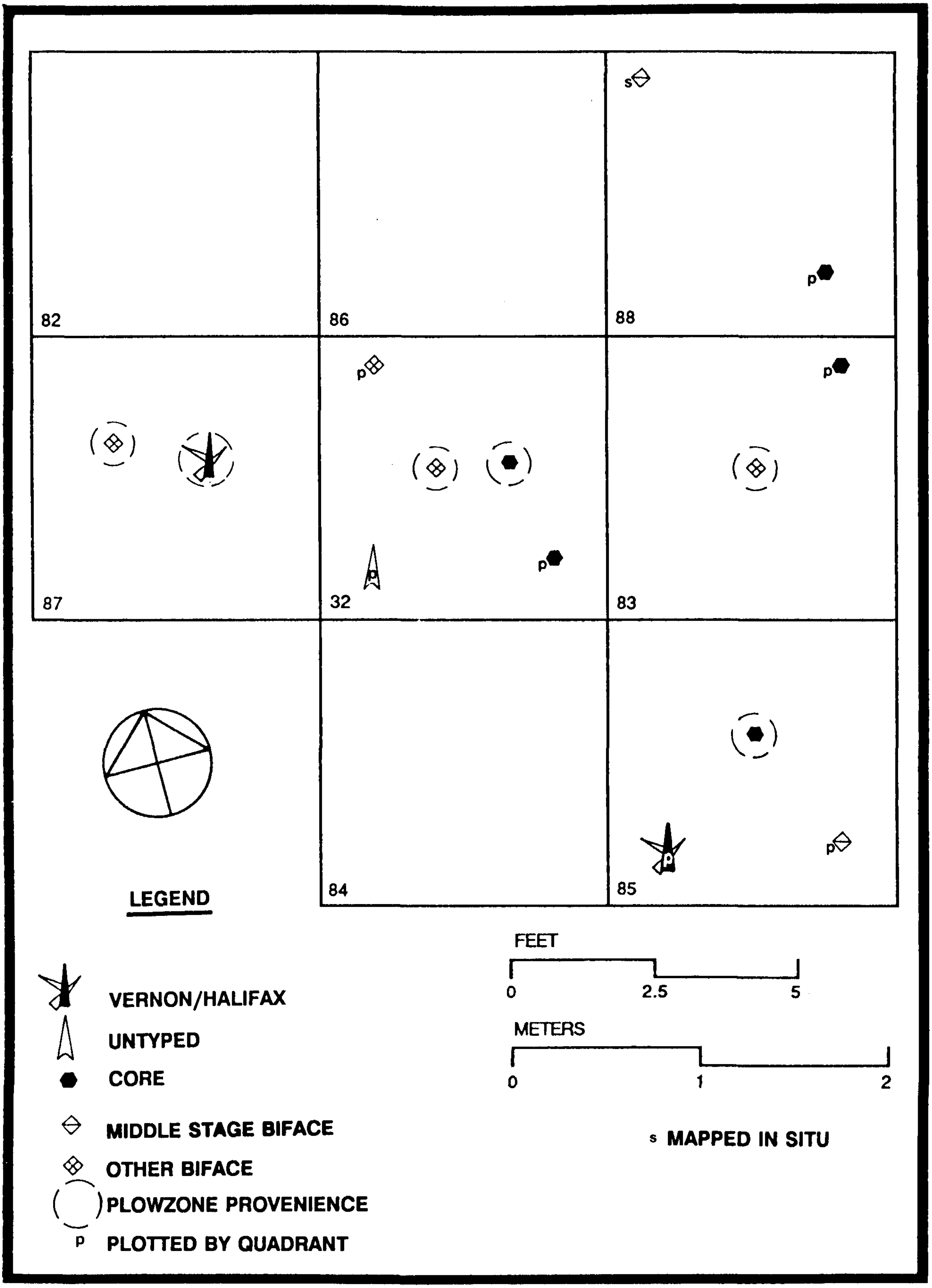


FIGURE 51: Distribution of Quartz Tools, Excavation Block 2

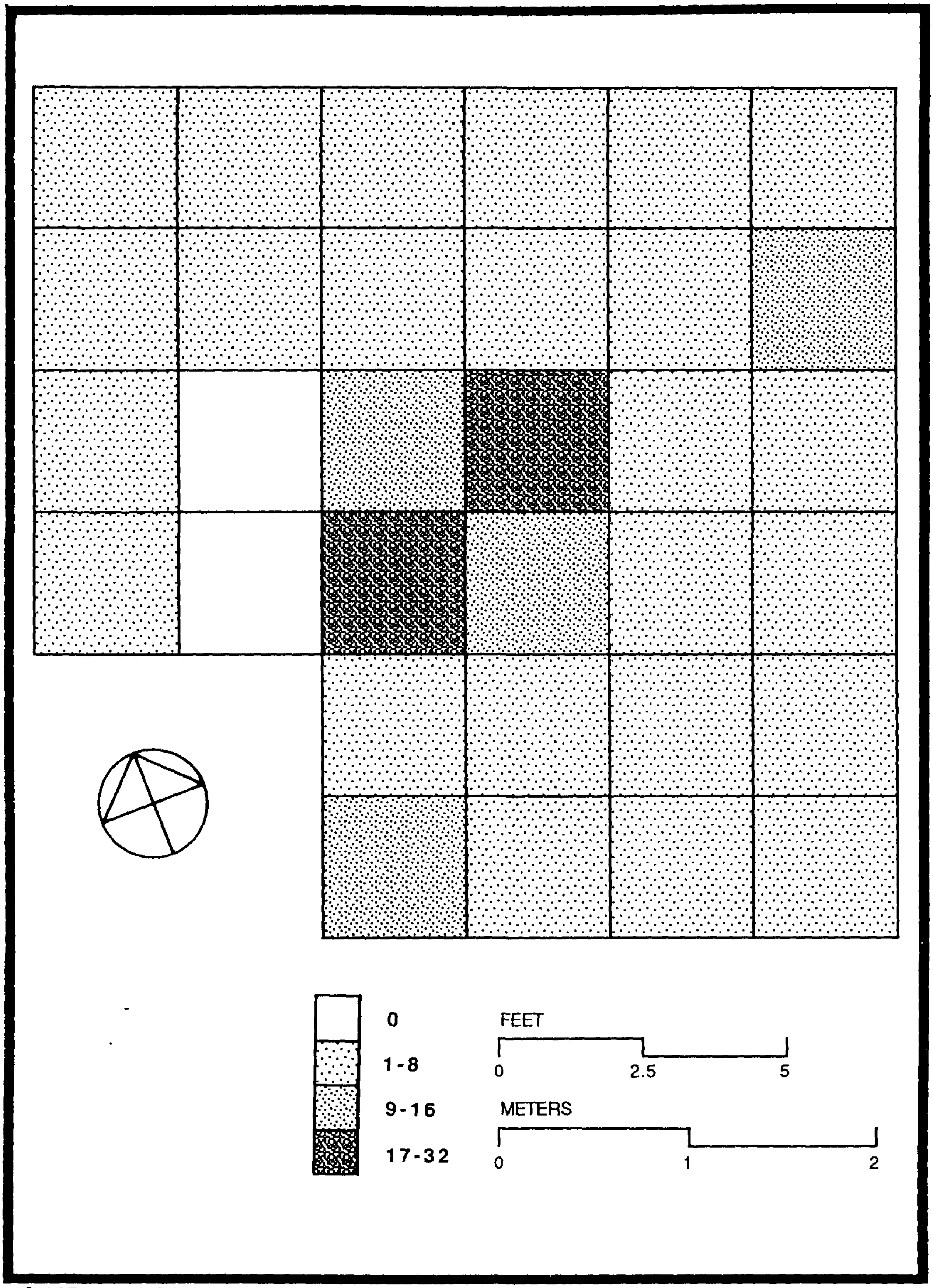


FIGURE 52: Distribution of Quartz Debitage, Excavation Block 2 Subsoil

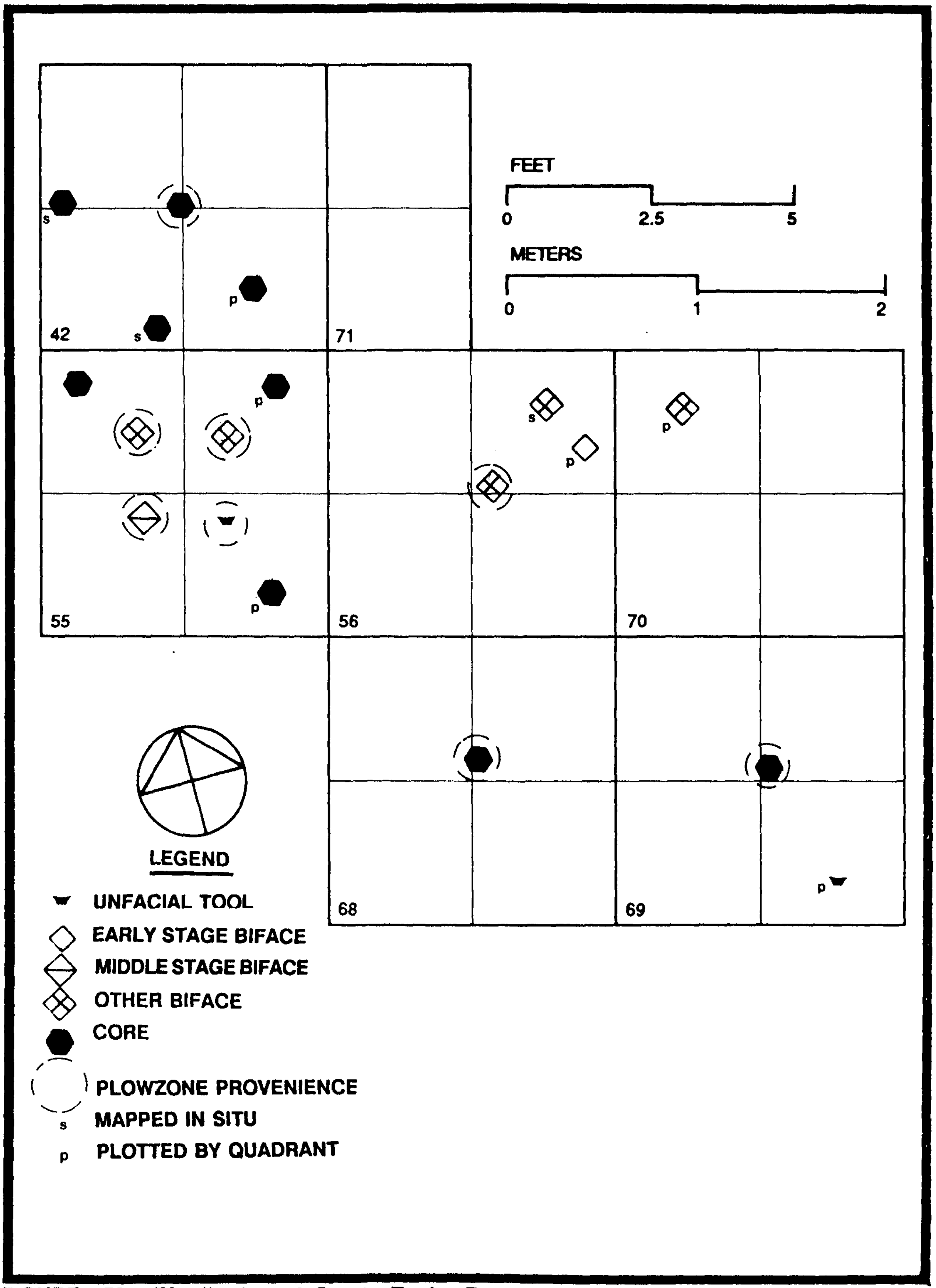


FIGURE 53: Distribution of Quartz Tools, Excavation Block 3

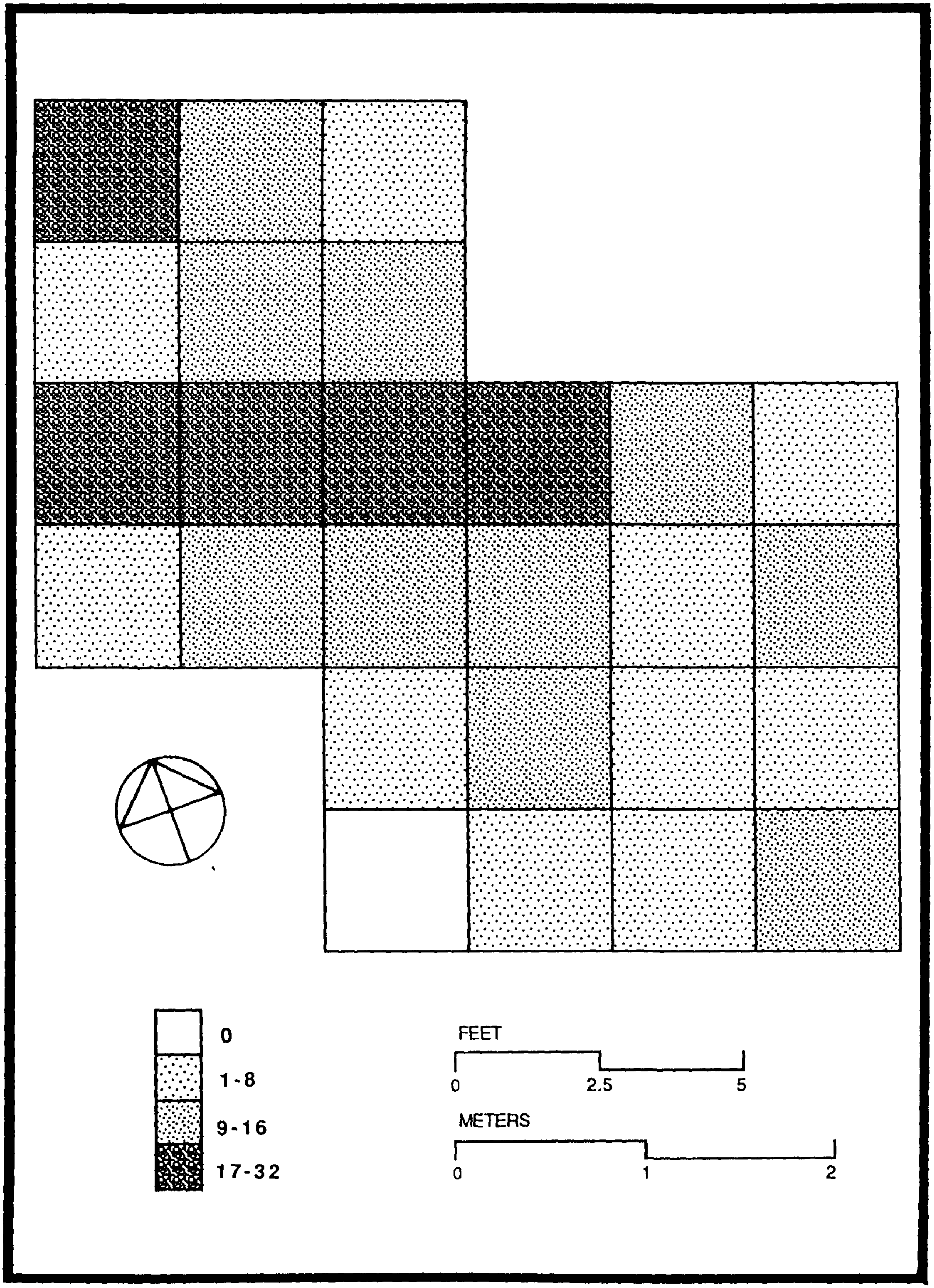


FIGURE 54: Distribution of Quartz Debitage, Excavation Block 3 Subsoil

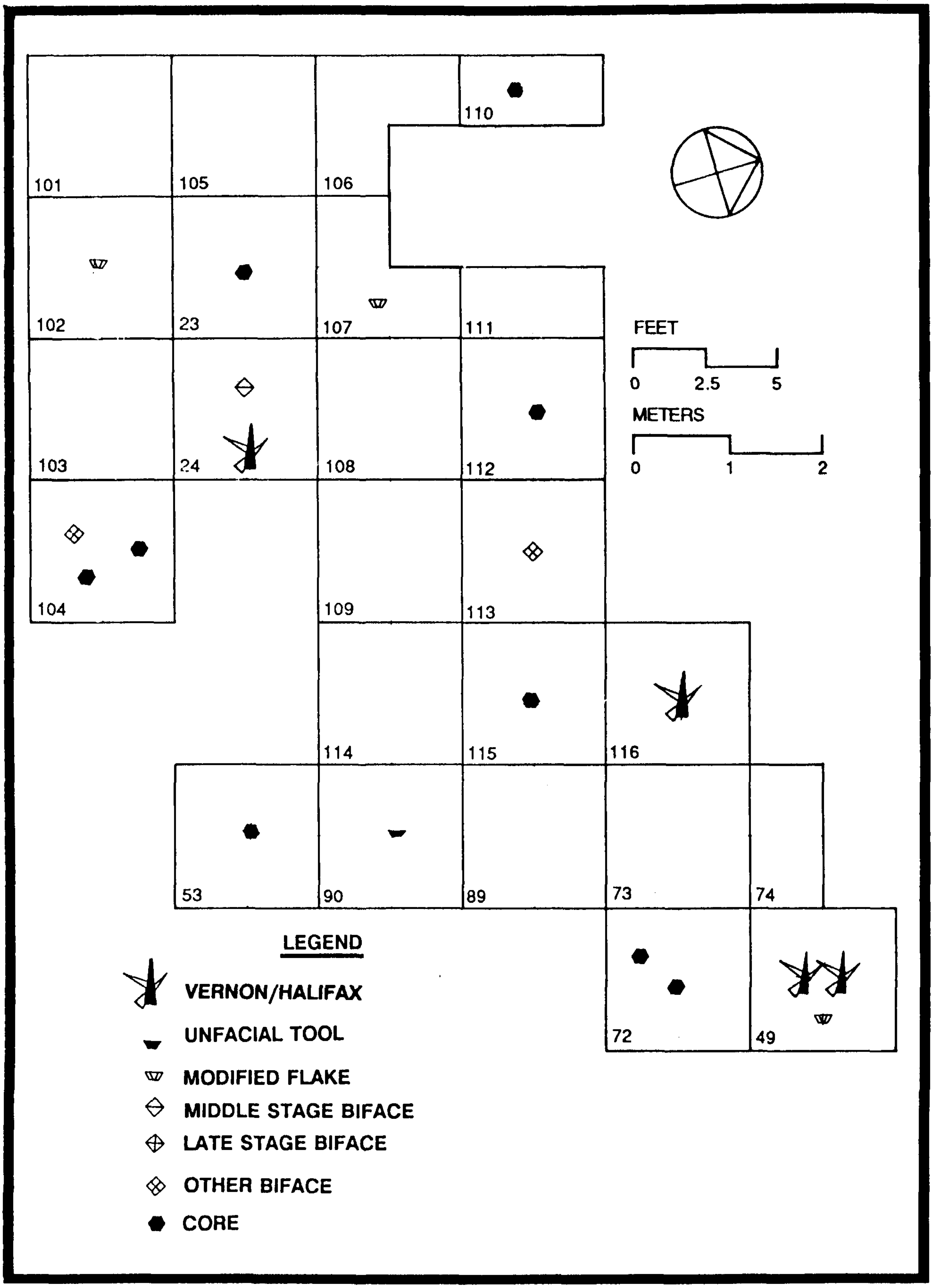


FIGURE 55: Distribution of Quartz Tools, Excavation Block 4 Plowzone

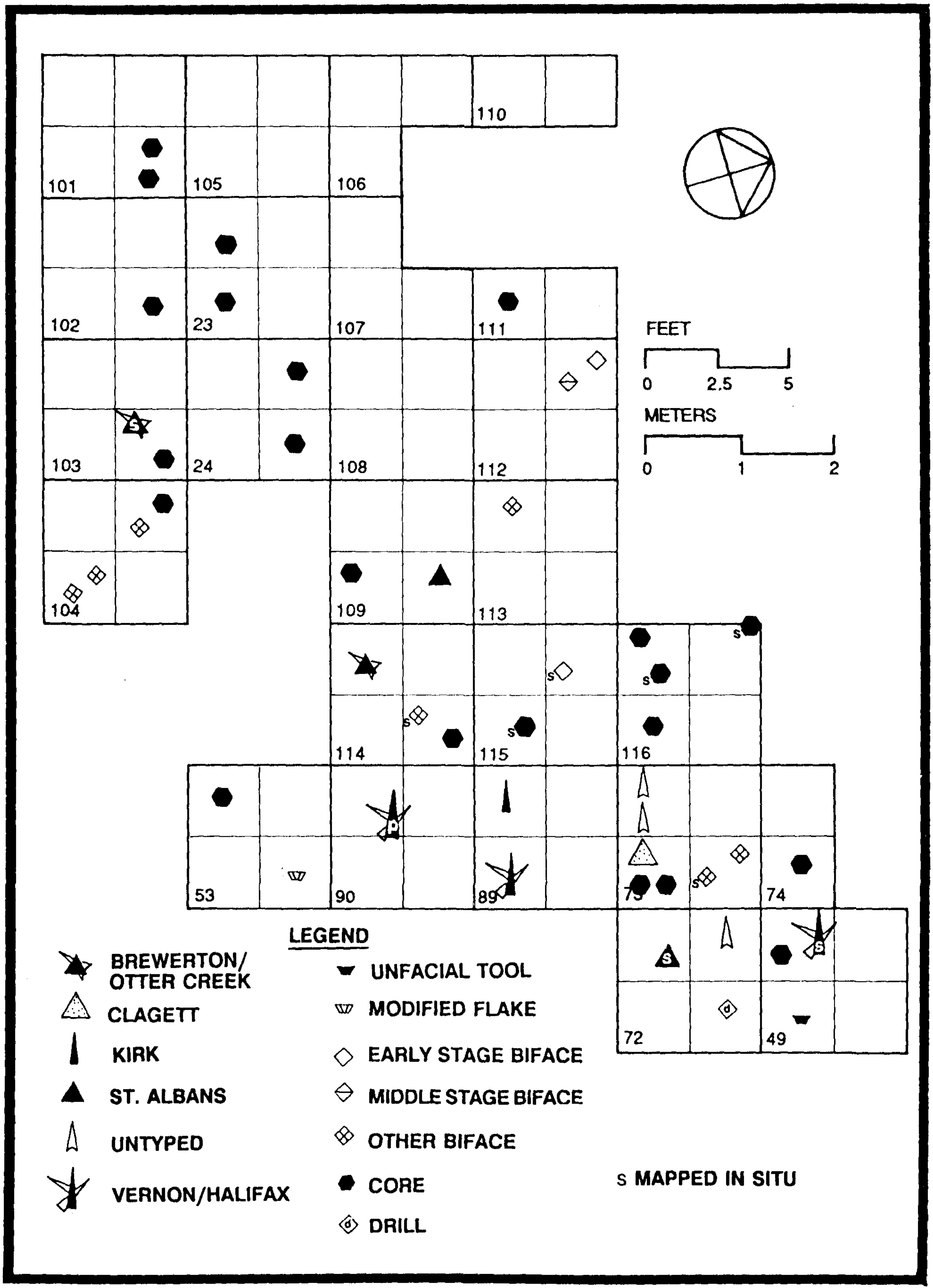


FIGURE 56: Distribution of Quartz Tools, Excavation Block 4 Subsoil

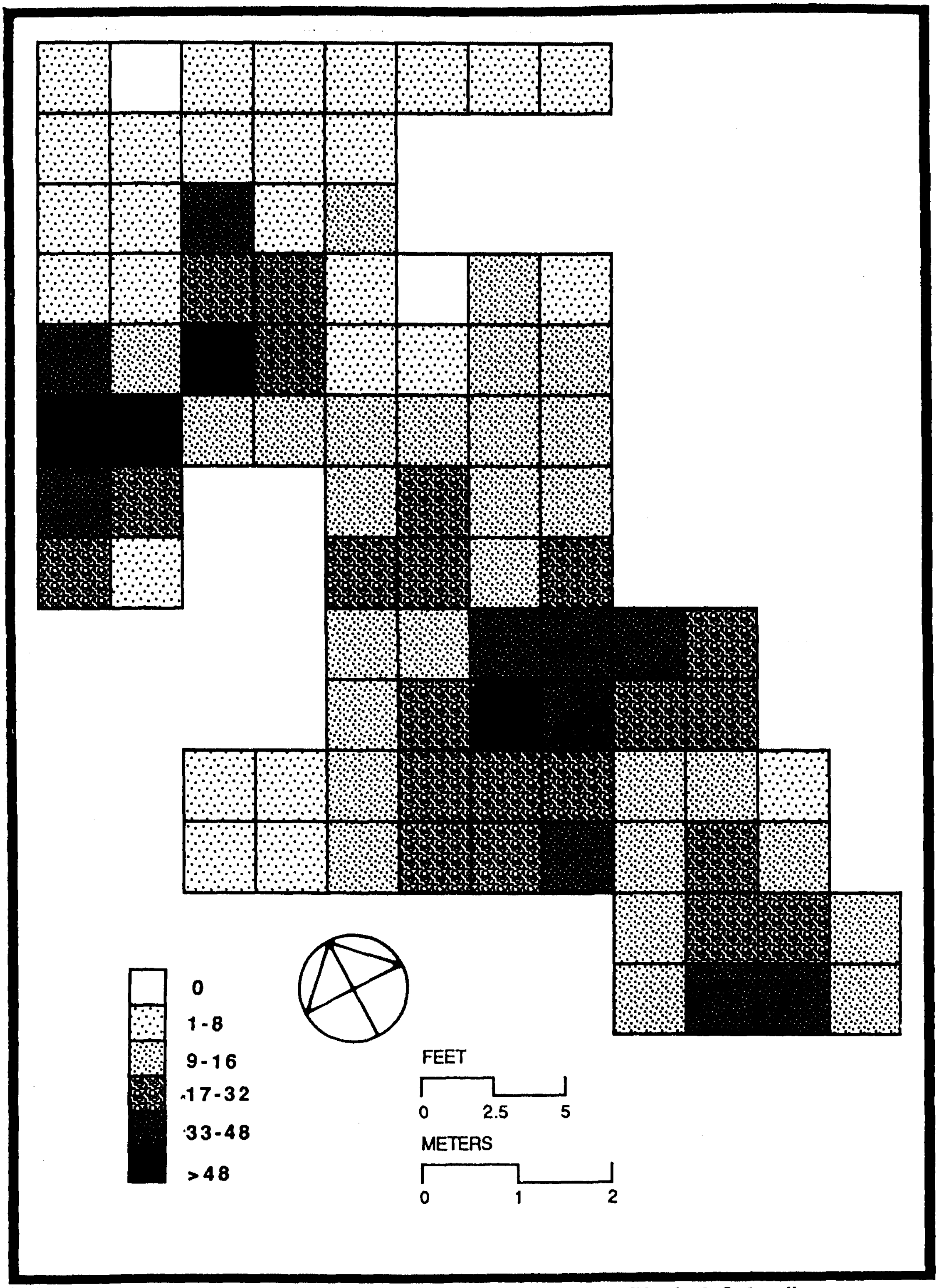


FIGURE 57: Distribution of Quartz Debitage, Excavation Block 4 Subsoil

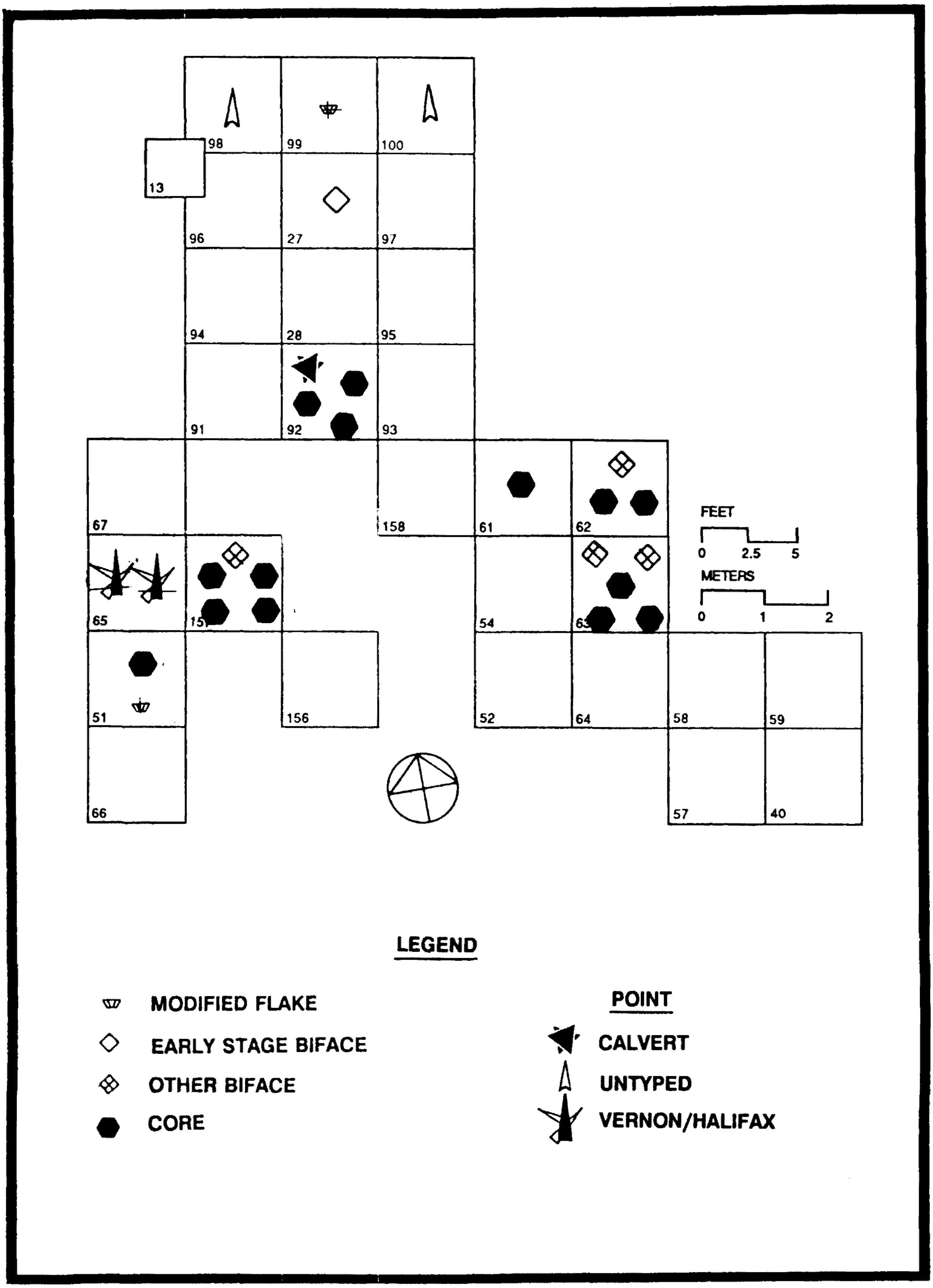


FIGURE 58: Distribution of Quartz Tools, Excavation Block 5 Plowzone

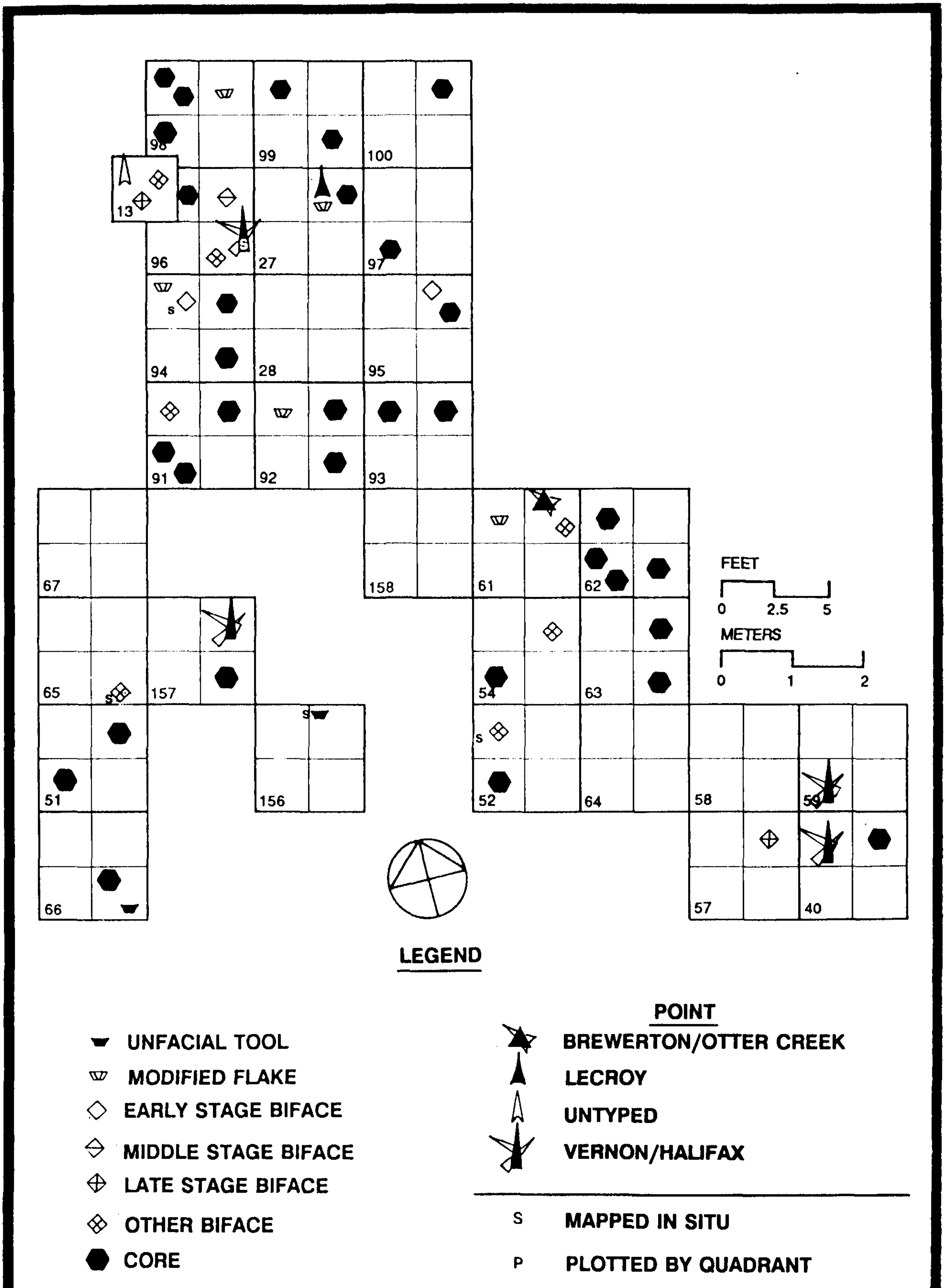


FIGURE 59: Distribution of Quartz Tools, Excavation Block 5 Subsoil

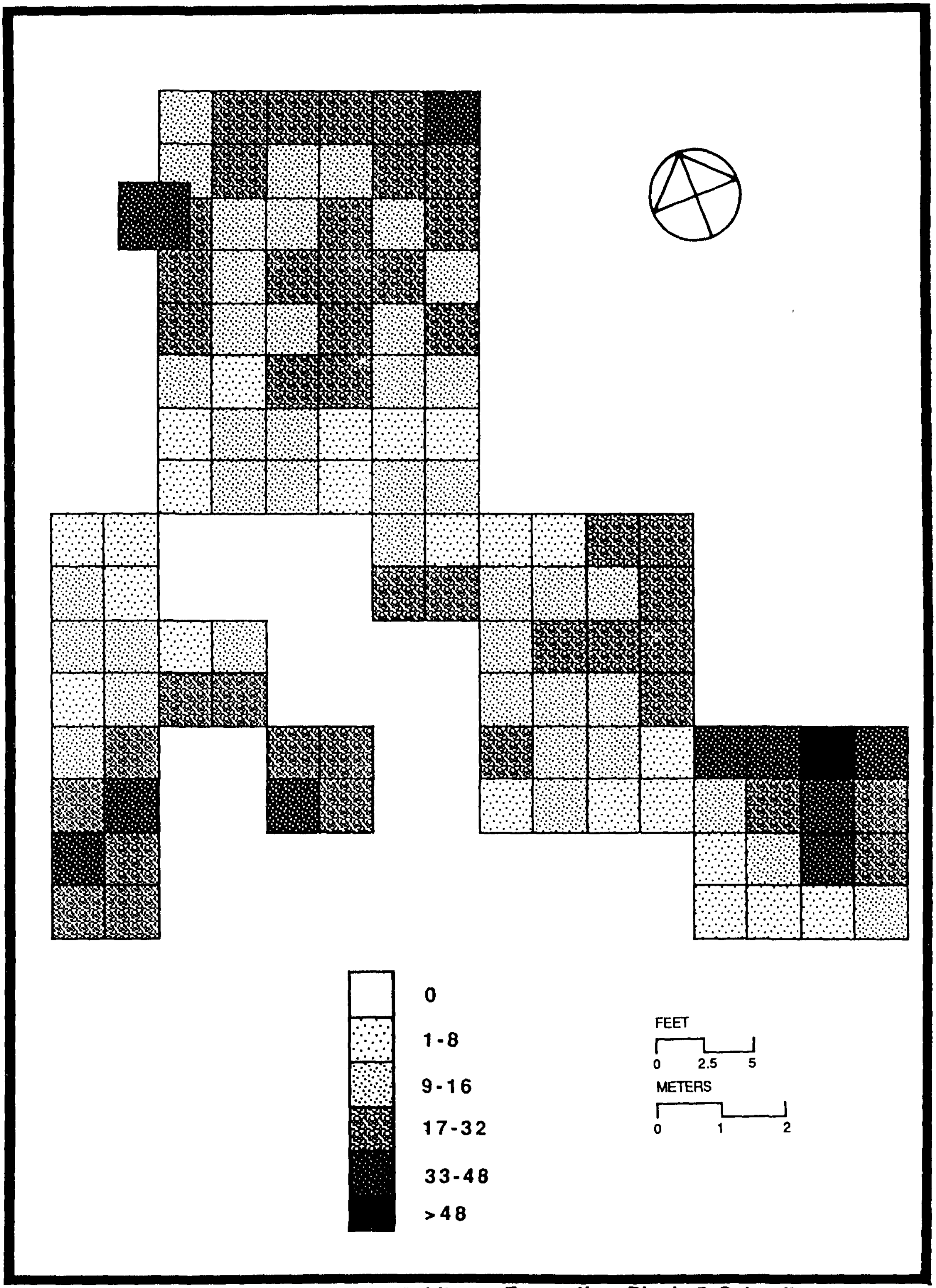


FIGURE 60: Distribution of Quartz Debitage, Excavation Block 5 Subsoil

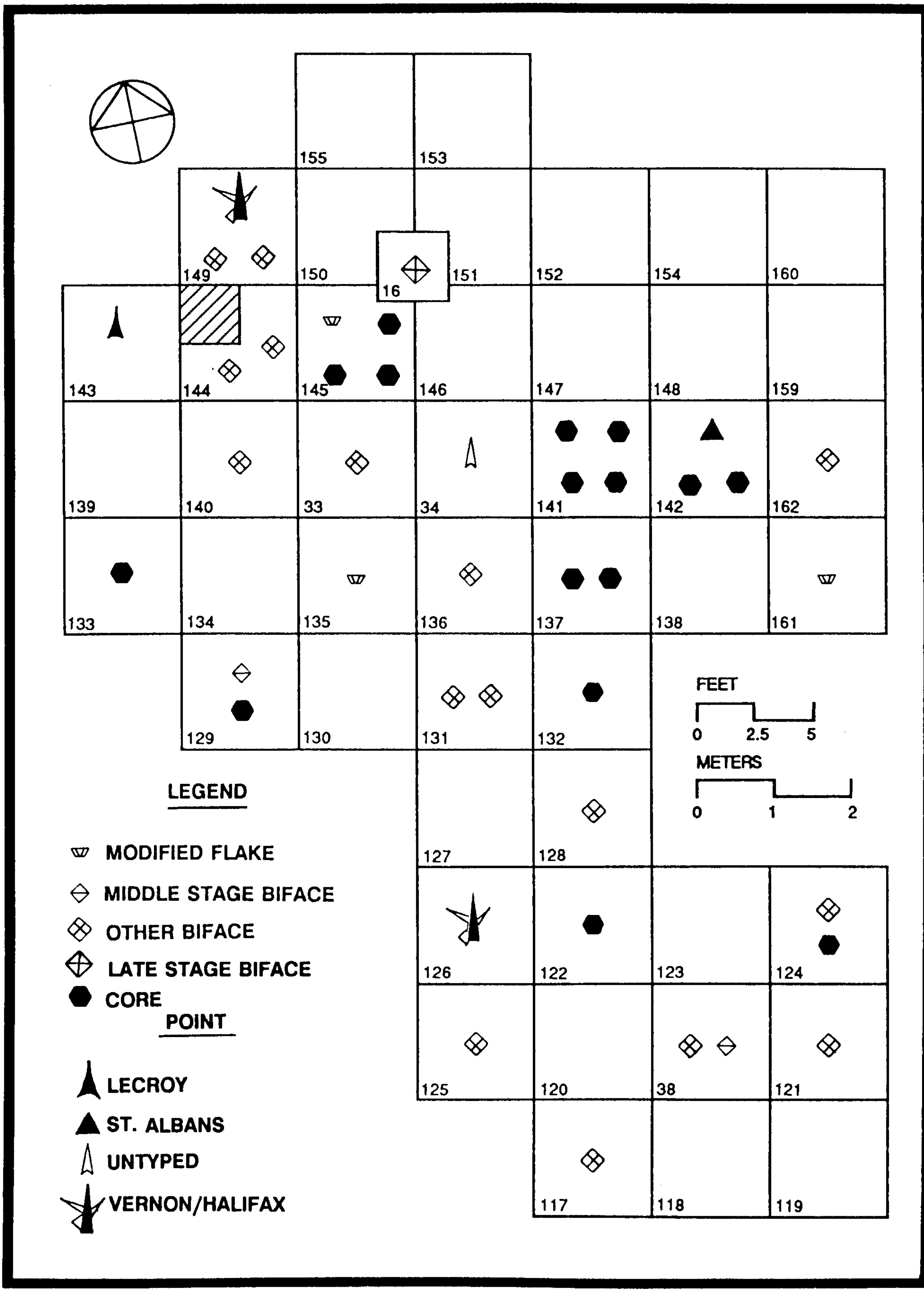


FIGURE 61: Distribution of Quartz Tools, Excavation Block 6 Plowzone

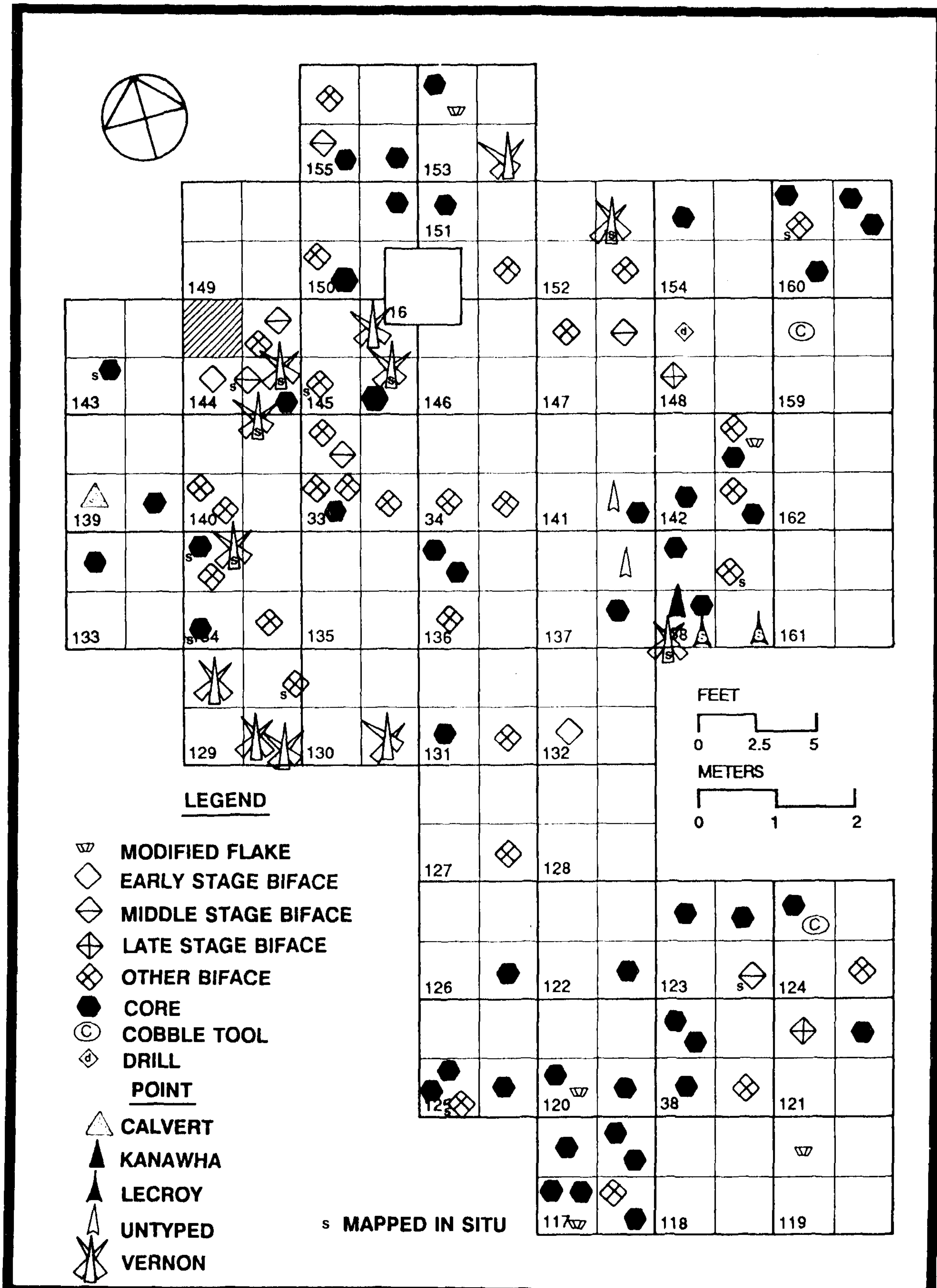


FIGURE 62: Distribution of Quartz Tools, Excavation Block 6 Subsoil

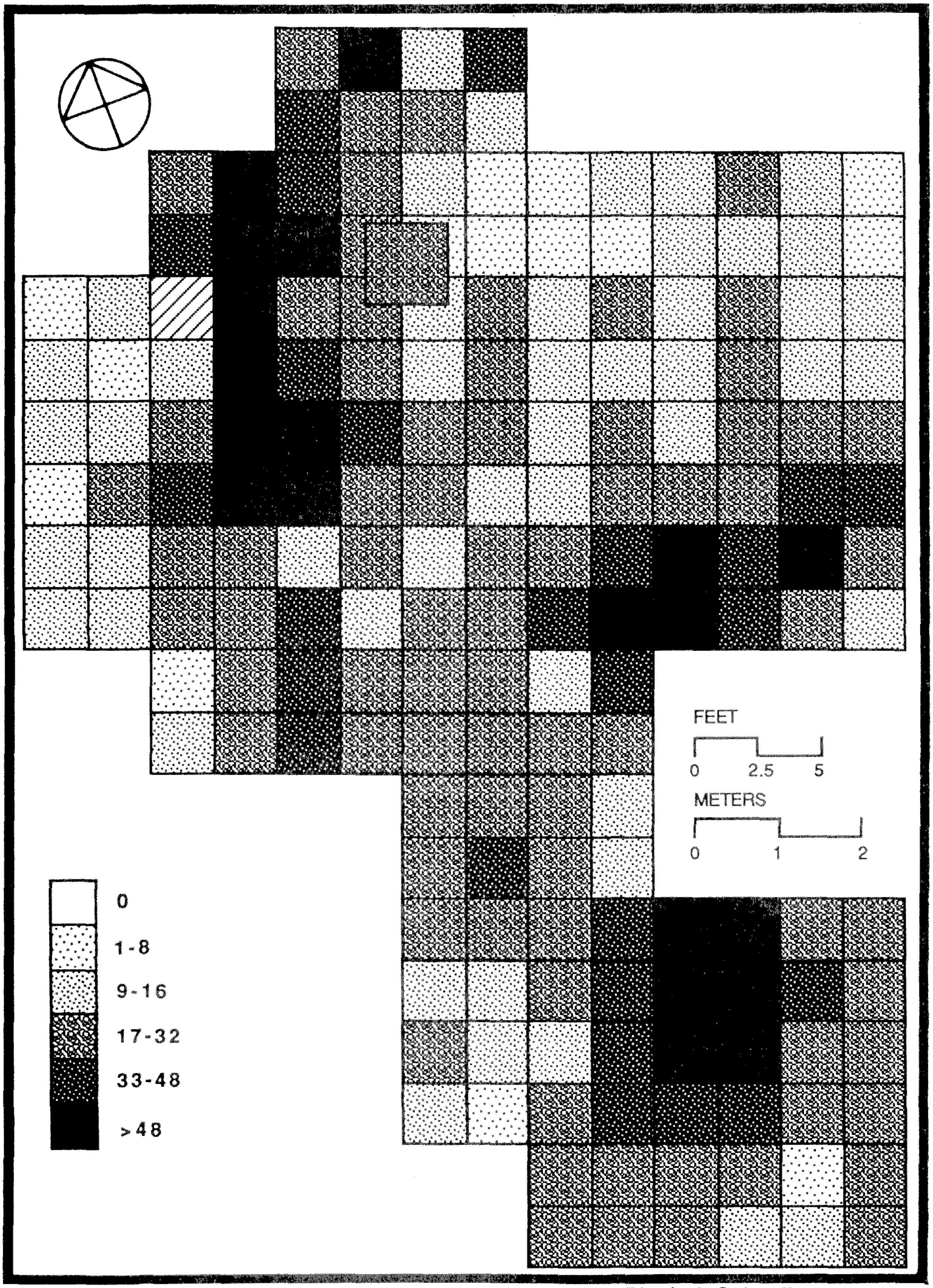


FIGURE 63: Distribution of Quartz Debitage, Excavation Block 6 Subsoil

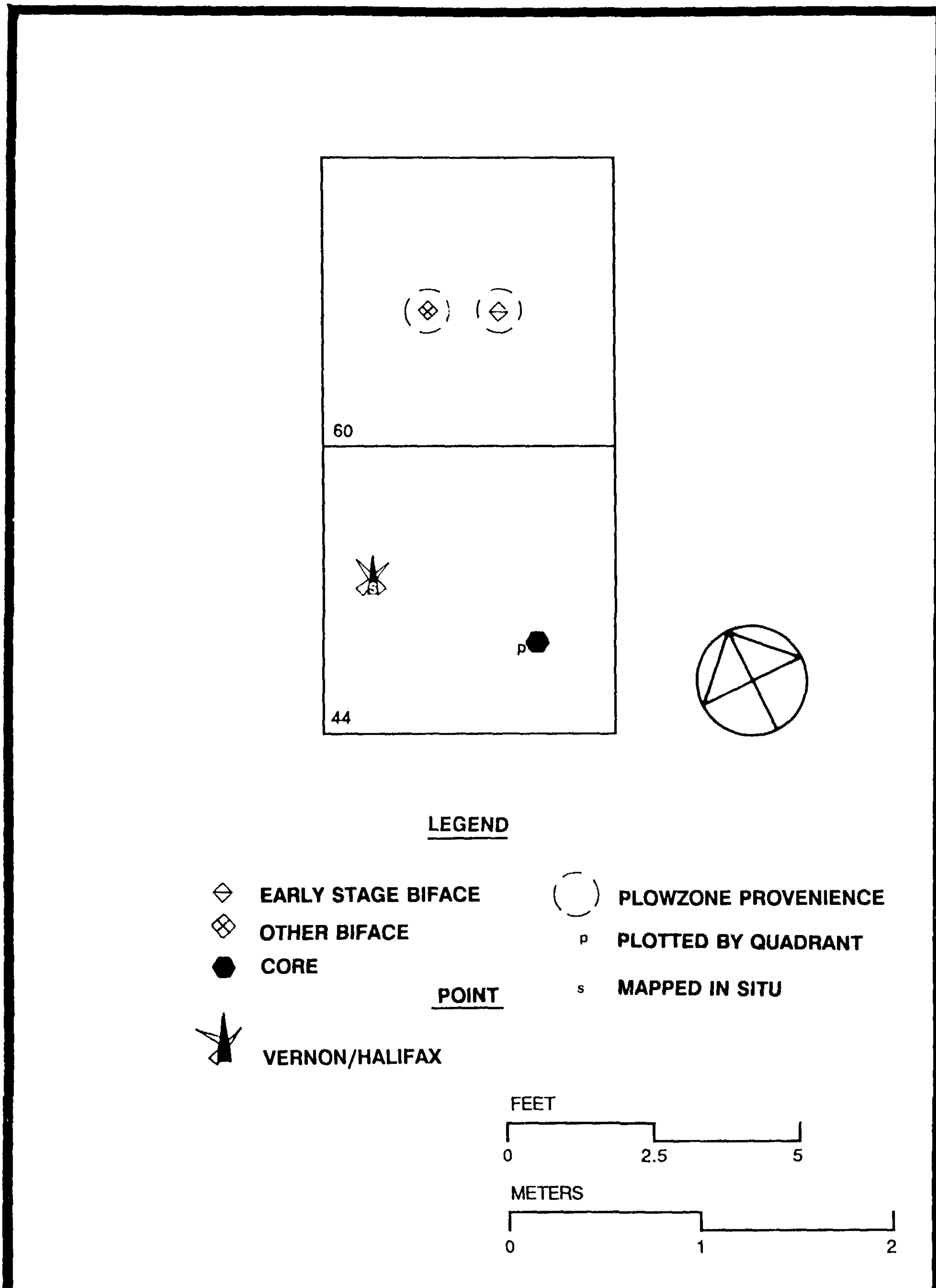


FIGURE 64: Distribution of Quartz Tools, Excavation Block 7

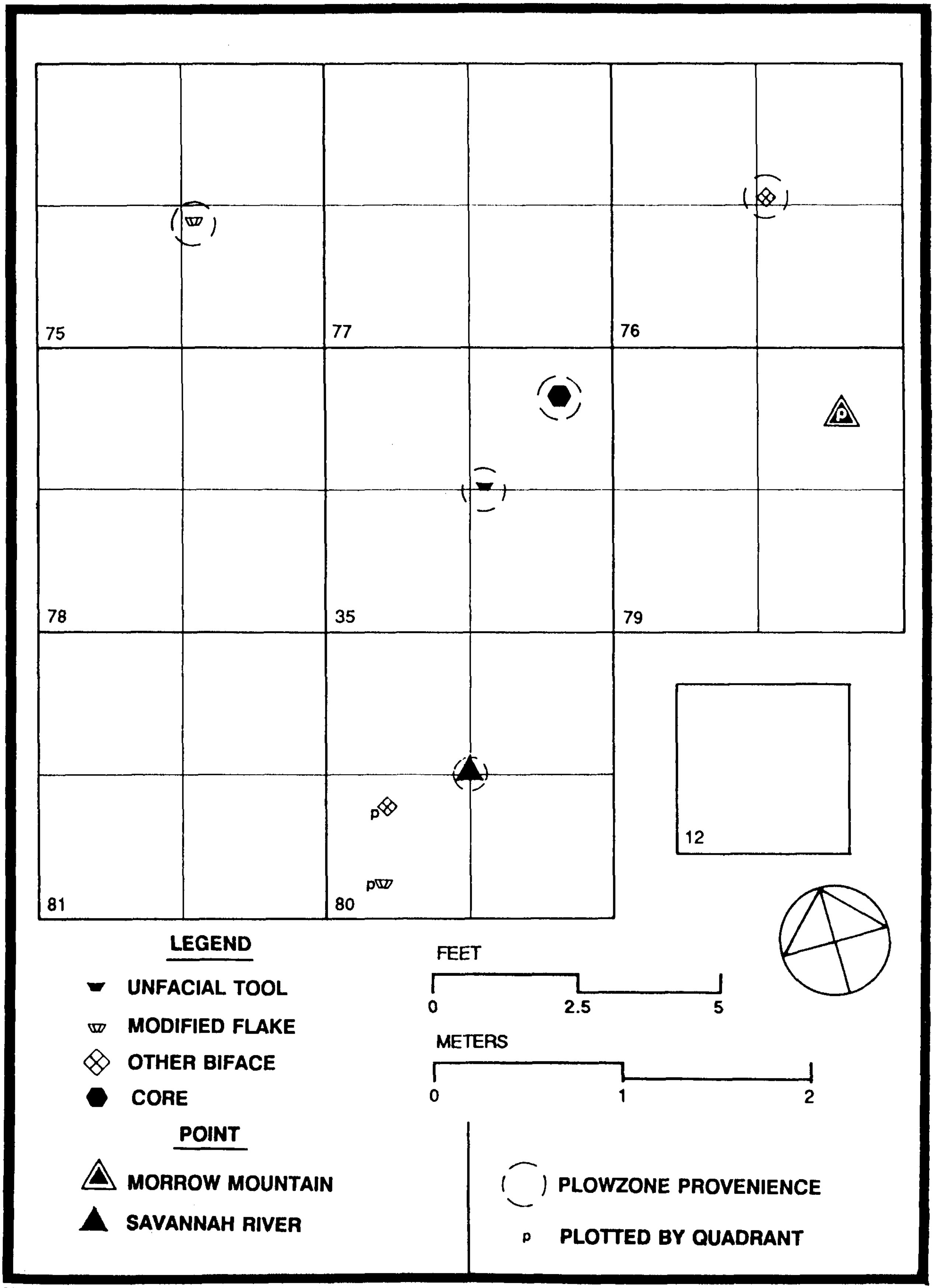


FIGURE 65: Distribution of Quartzite Tools, Excavation Block 1

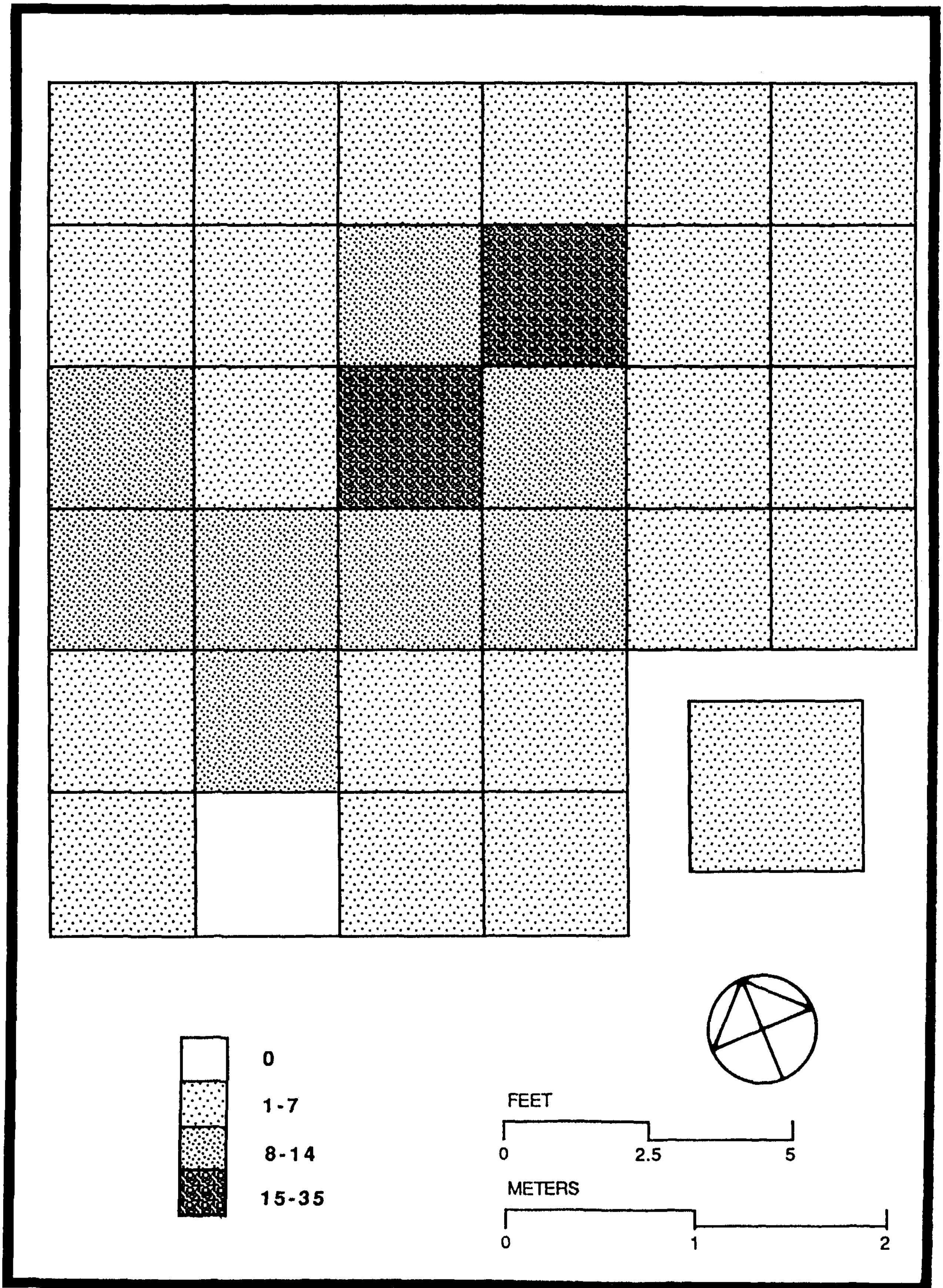


FIGURE 66: Distribution of Quartzite Debitage, Excavation Block 1 Subsoil

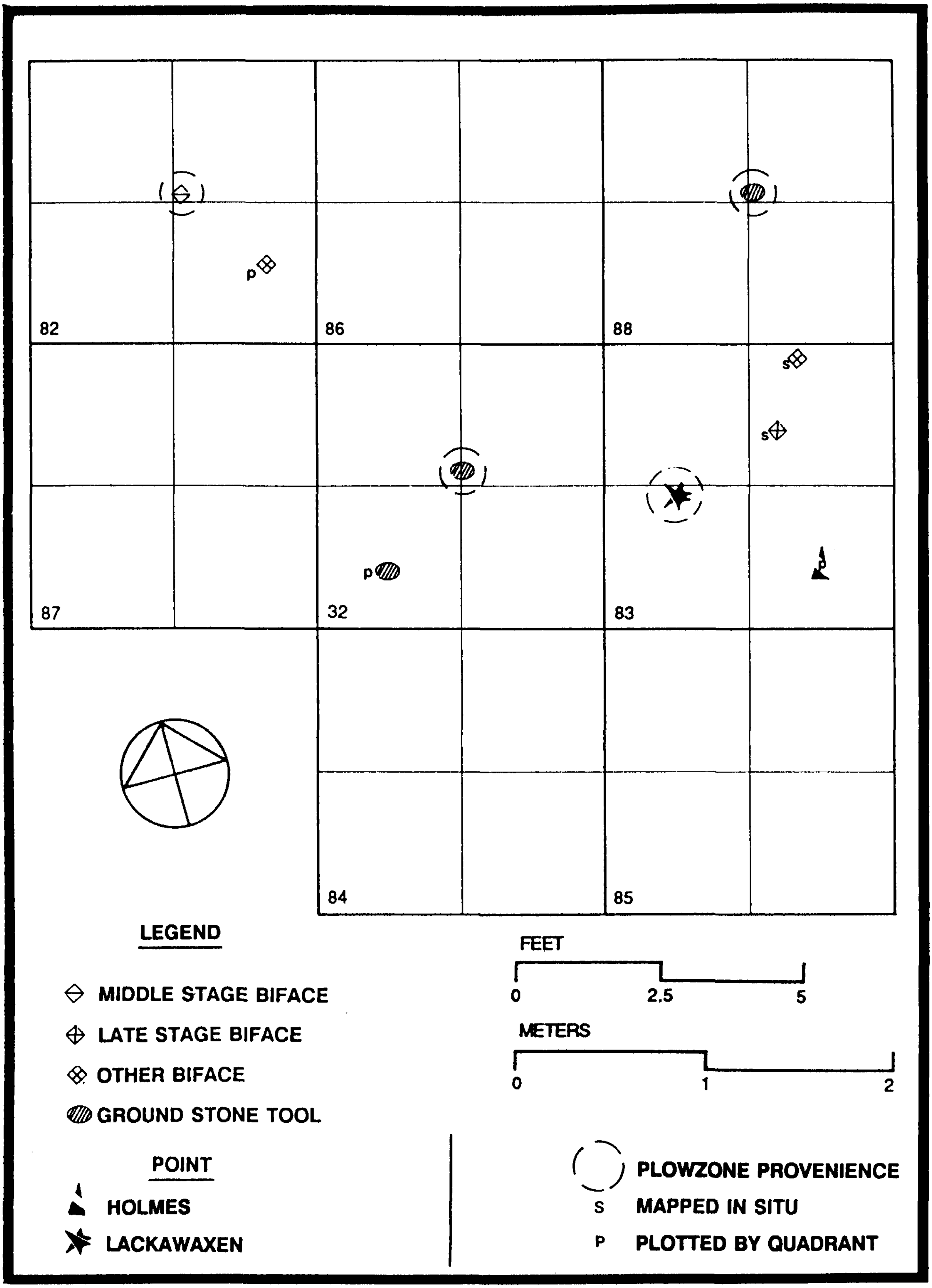


FIGURE 67: Distribution of Quartzite Tools, Excavation Block 2

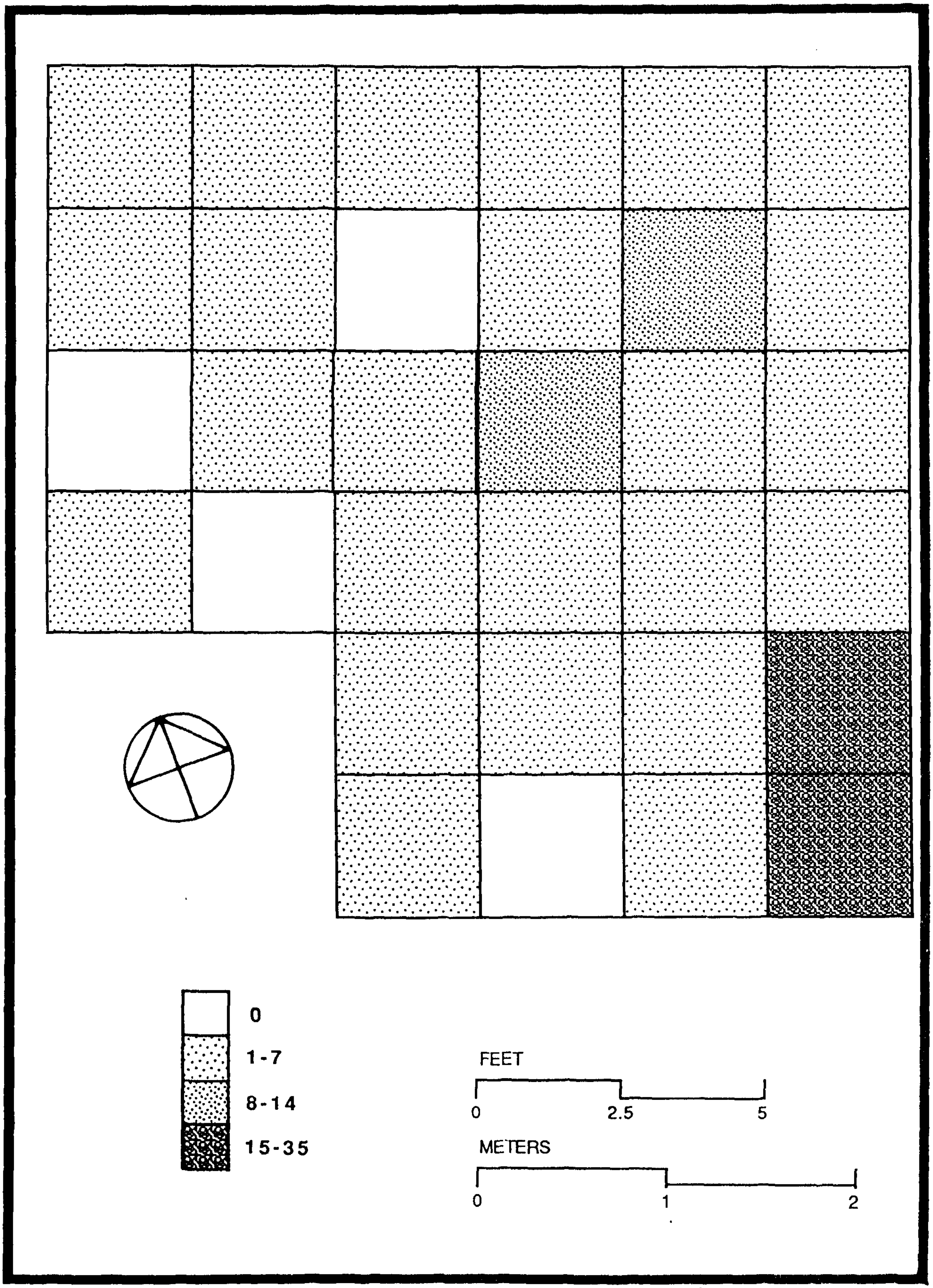


FIGURE 68: Distribution of Quartzite Debitage, Excavation Block 2 Subsoil

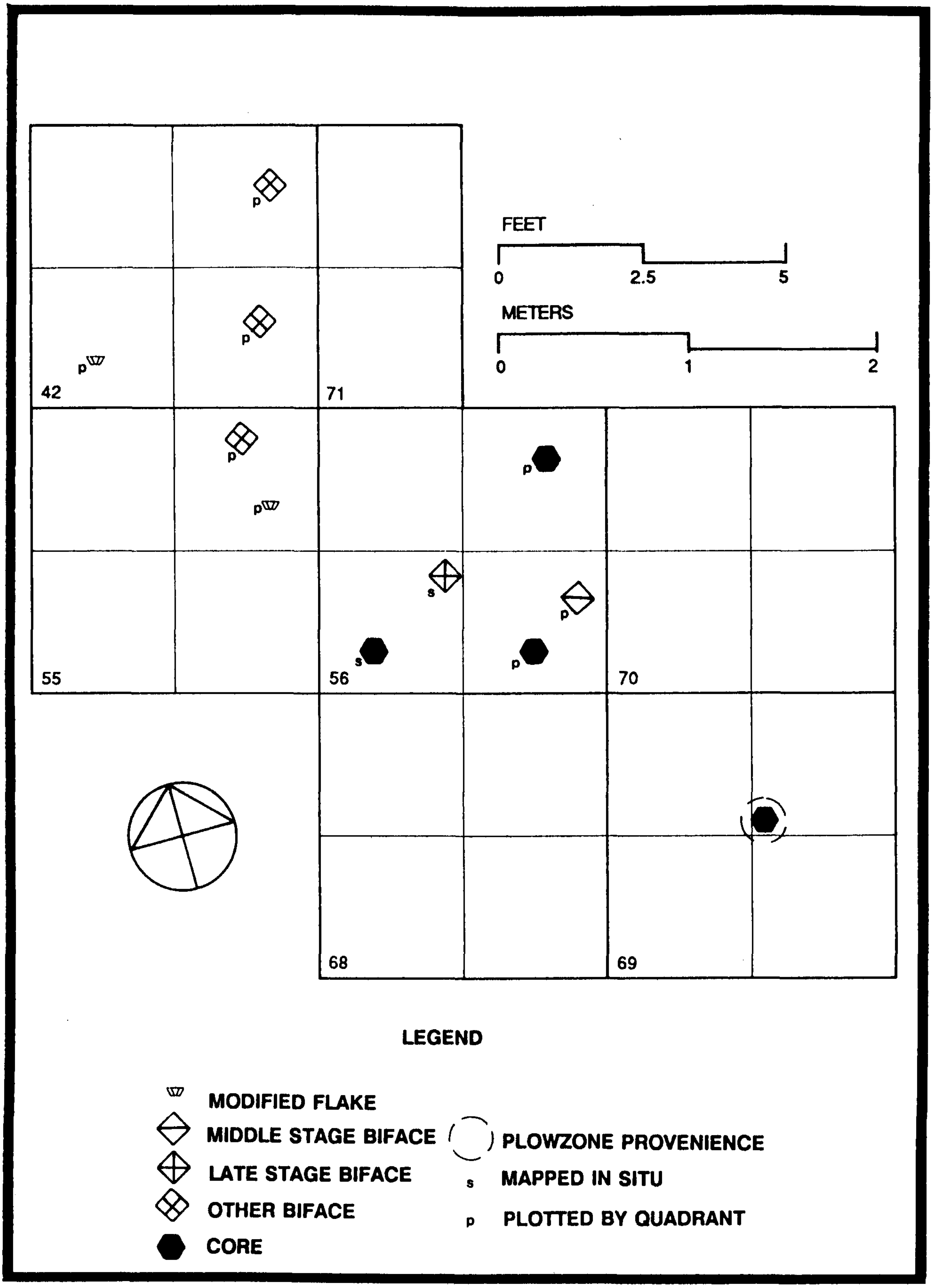


FIGURE 69: Distribution of Quartzite Tools, Excavation Block 3

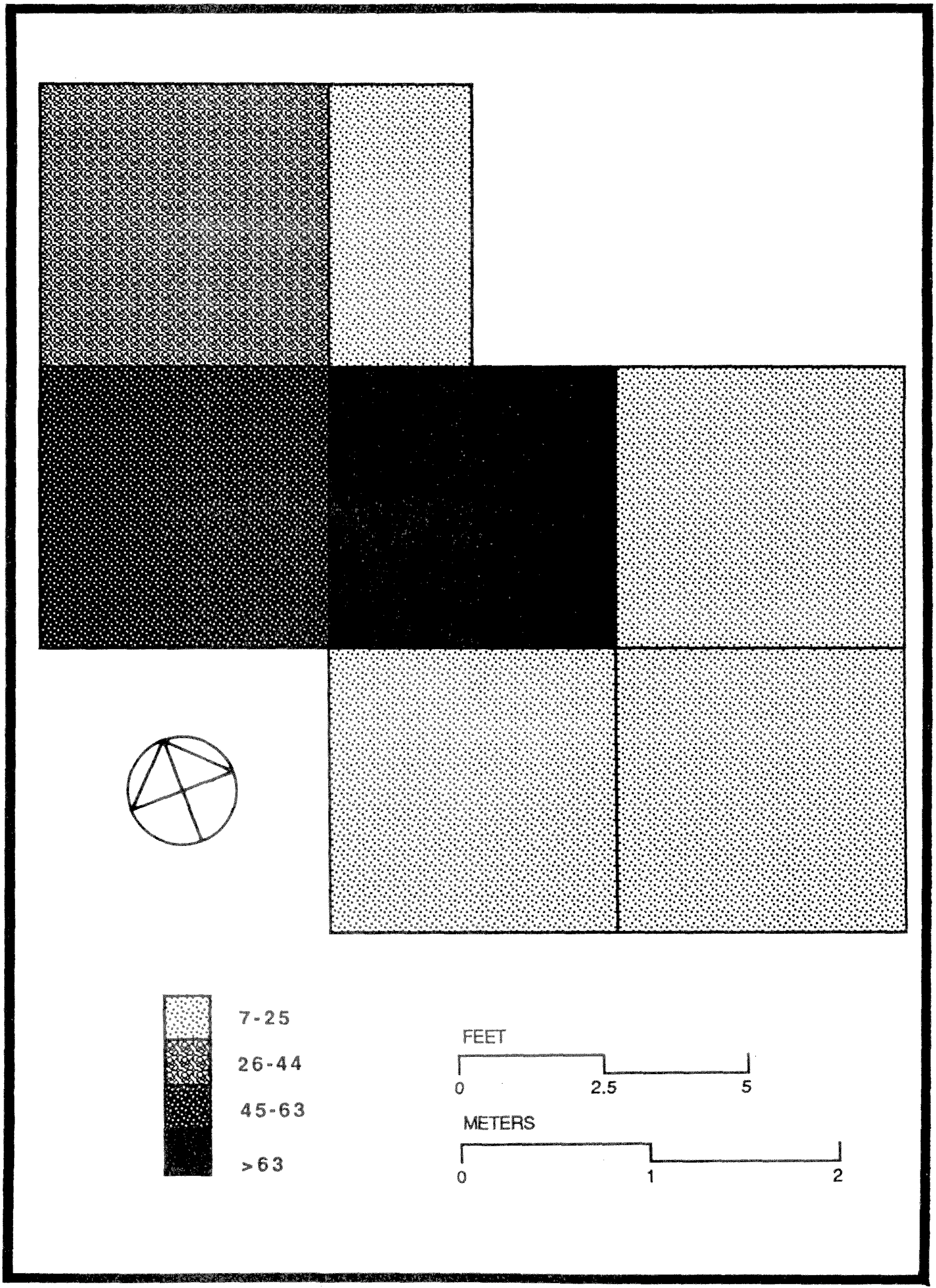


FIGURE 70: Distribution of Quartzite Debitage, Excavation Block 3 Plowzone

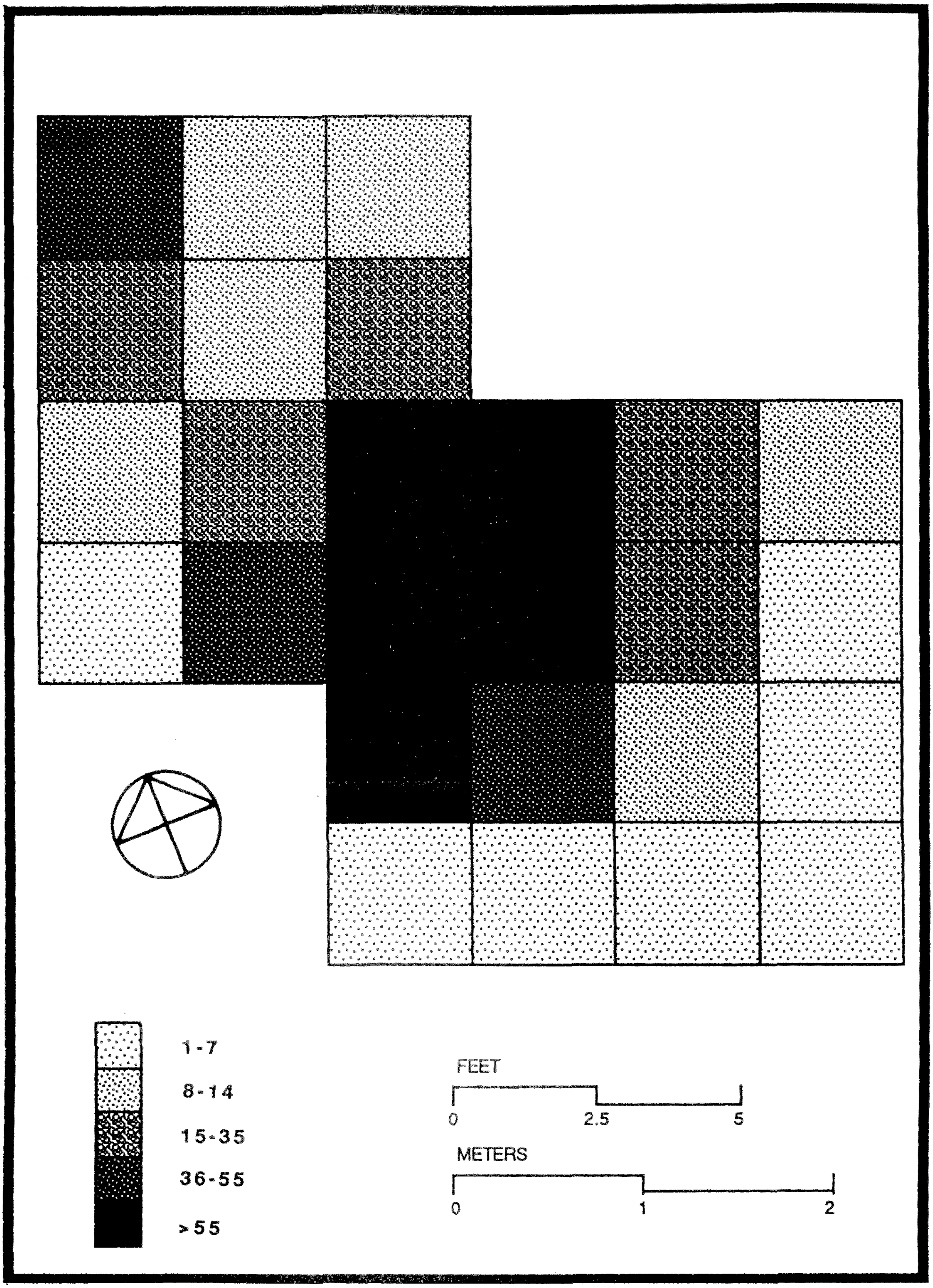


FIGURE 71: Distribution of Quartzite Debitage, Excavation Block 3 Subsoil

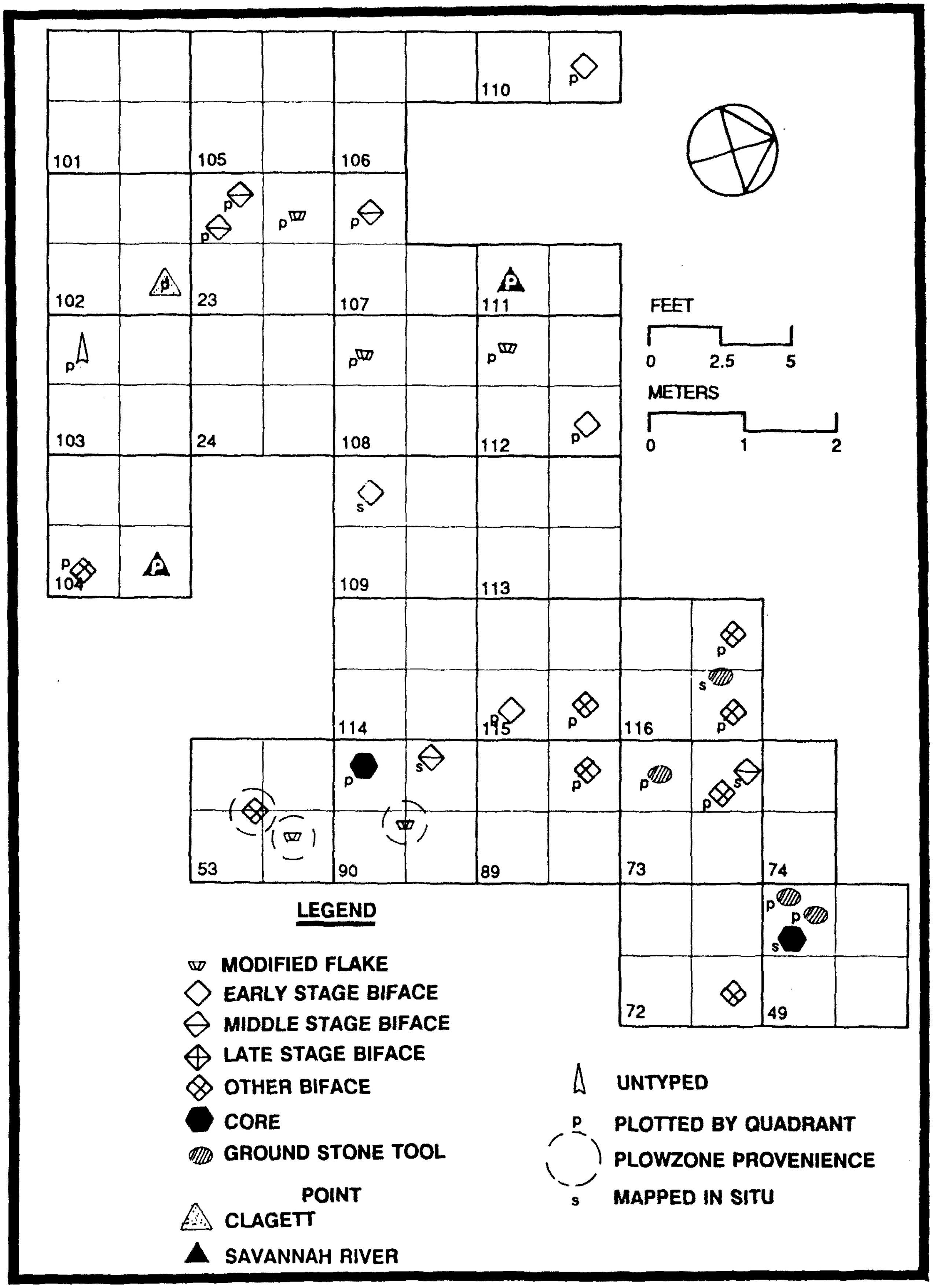


FIGURE 72: Distribution of Quartzite Tools, Excavation Block 4

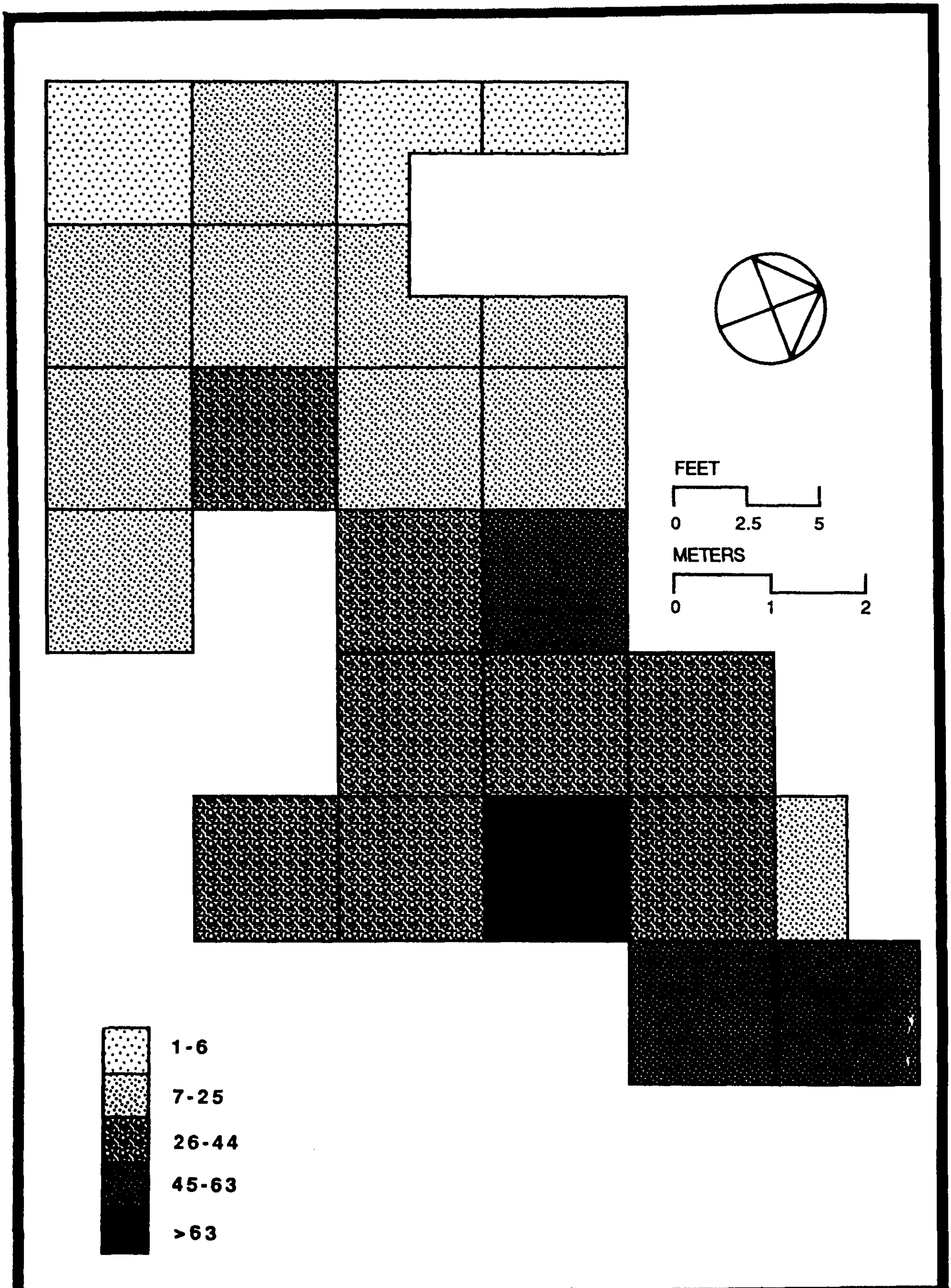


FIGURE 73: Distribution of Quartzite Debitage, Excavation Block 4 Plowzone

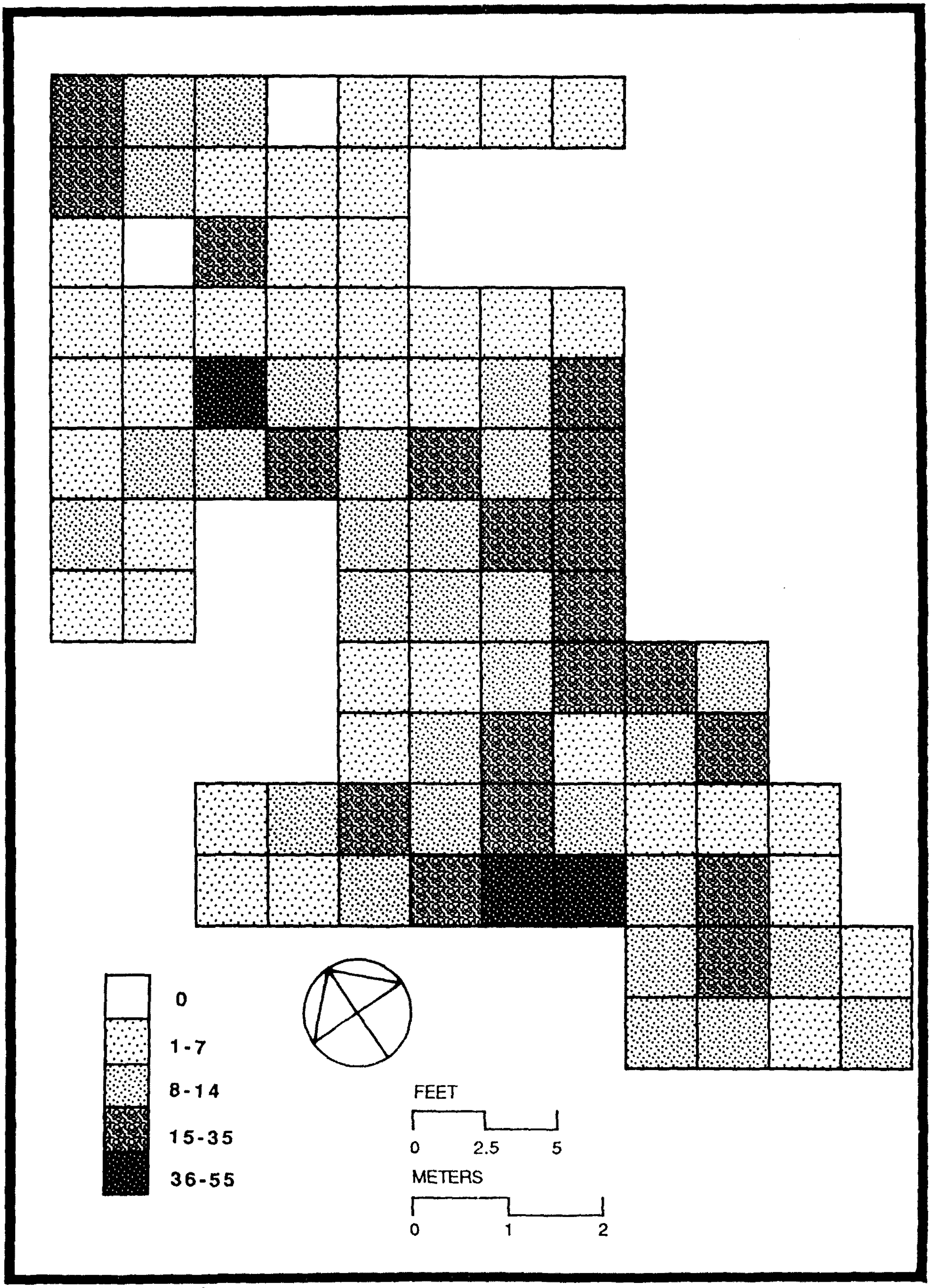


FIGURE 74: Distribution of Quartzite Debitage, Excavation Block 4 Subsoil

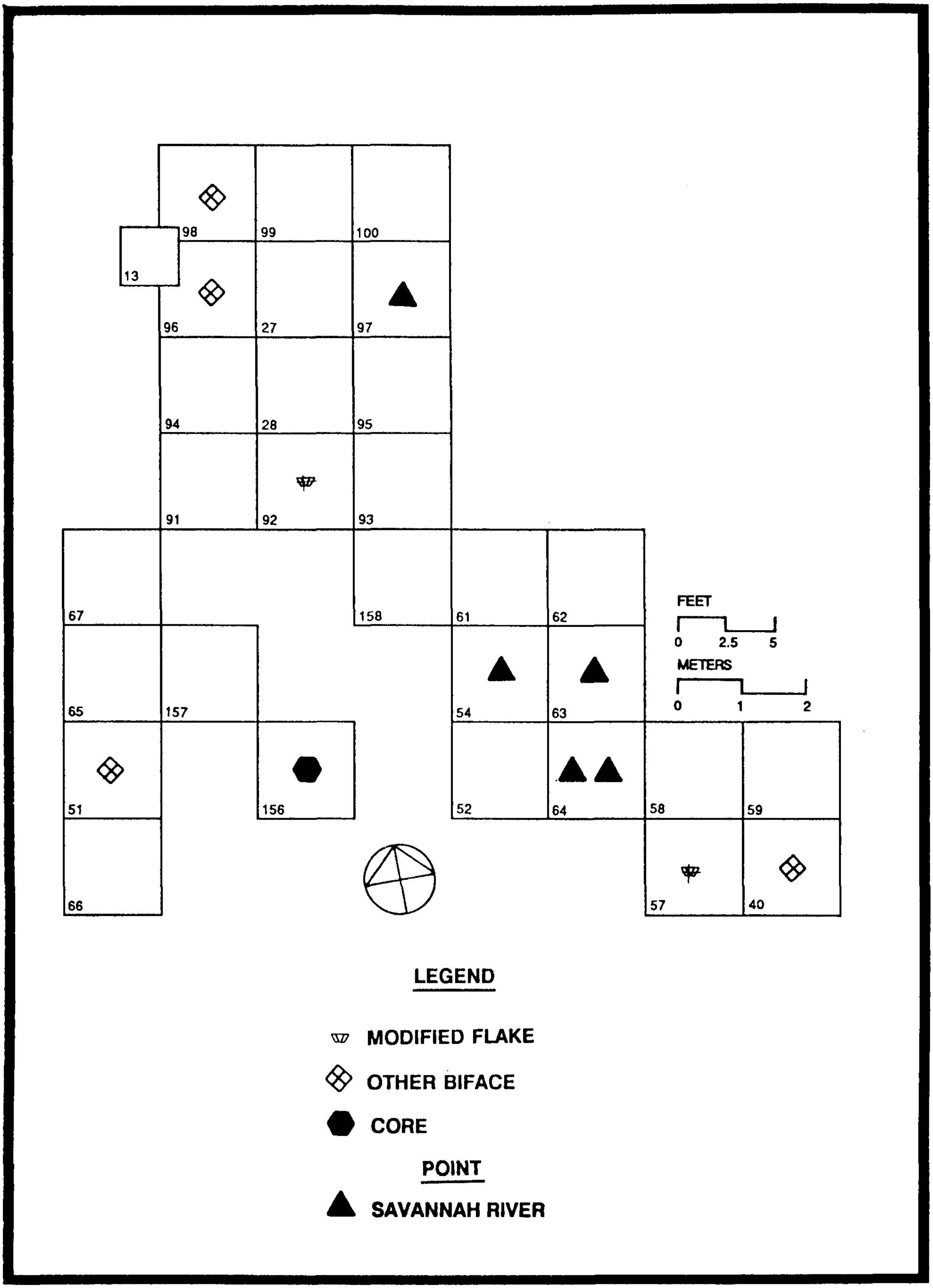


FIGURE 75: Distribution of Quartzite Tools, Excavation Block 5 Plowzone

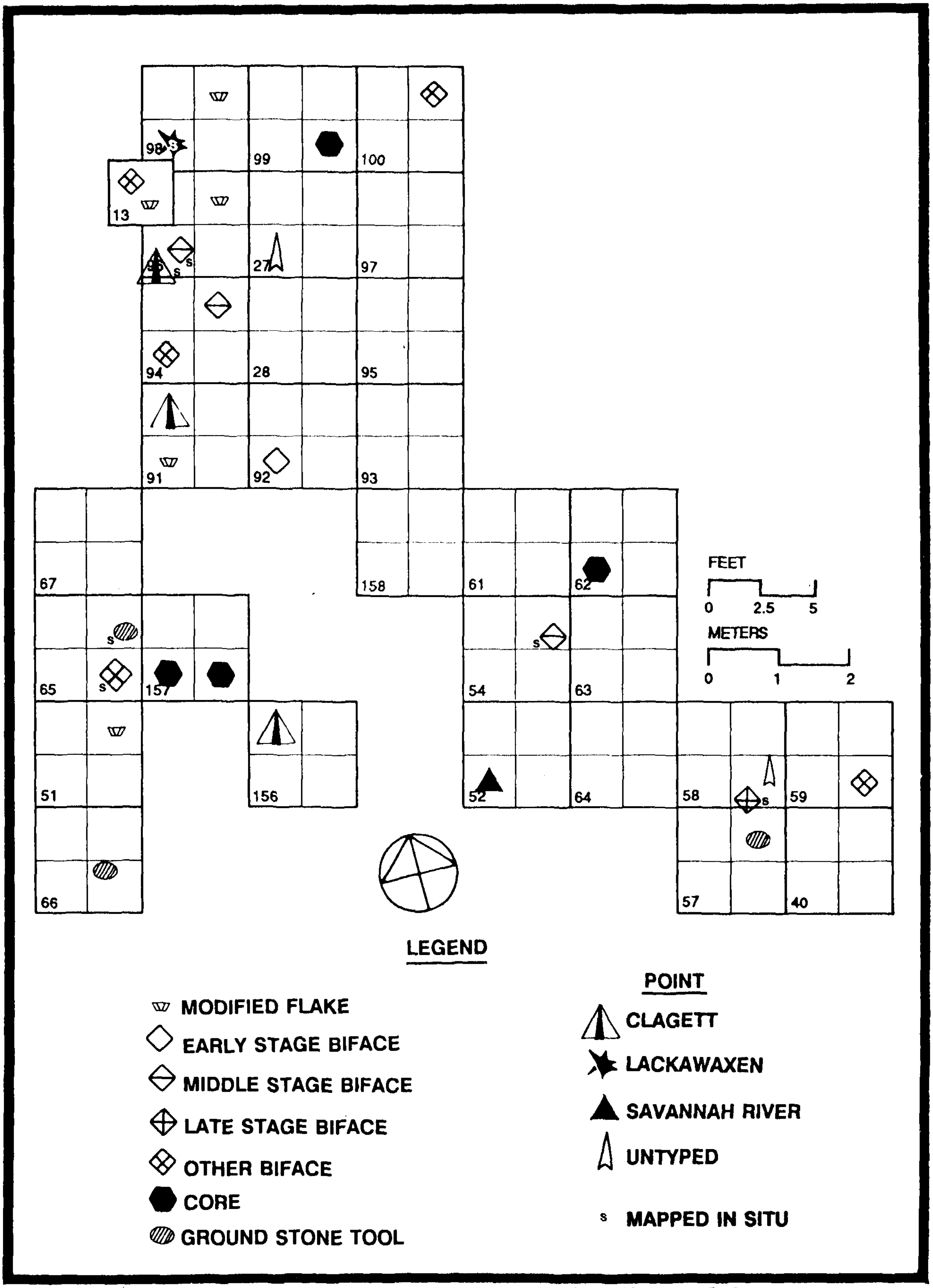


FIGURE 76: Distribution of Quartzite Tools, Excavation Block 5 Subsoil

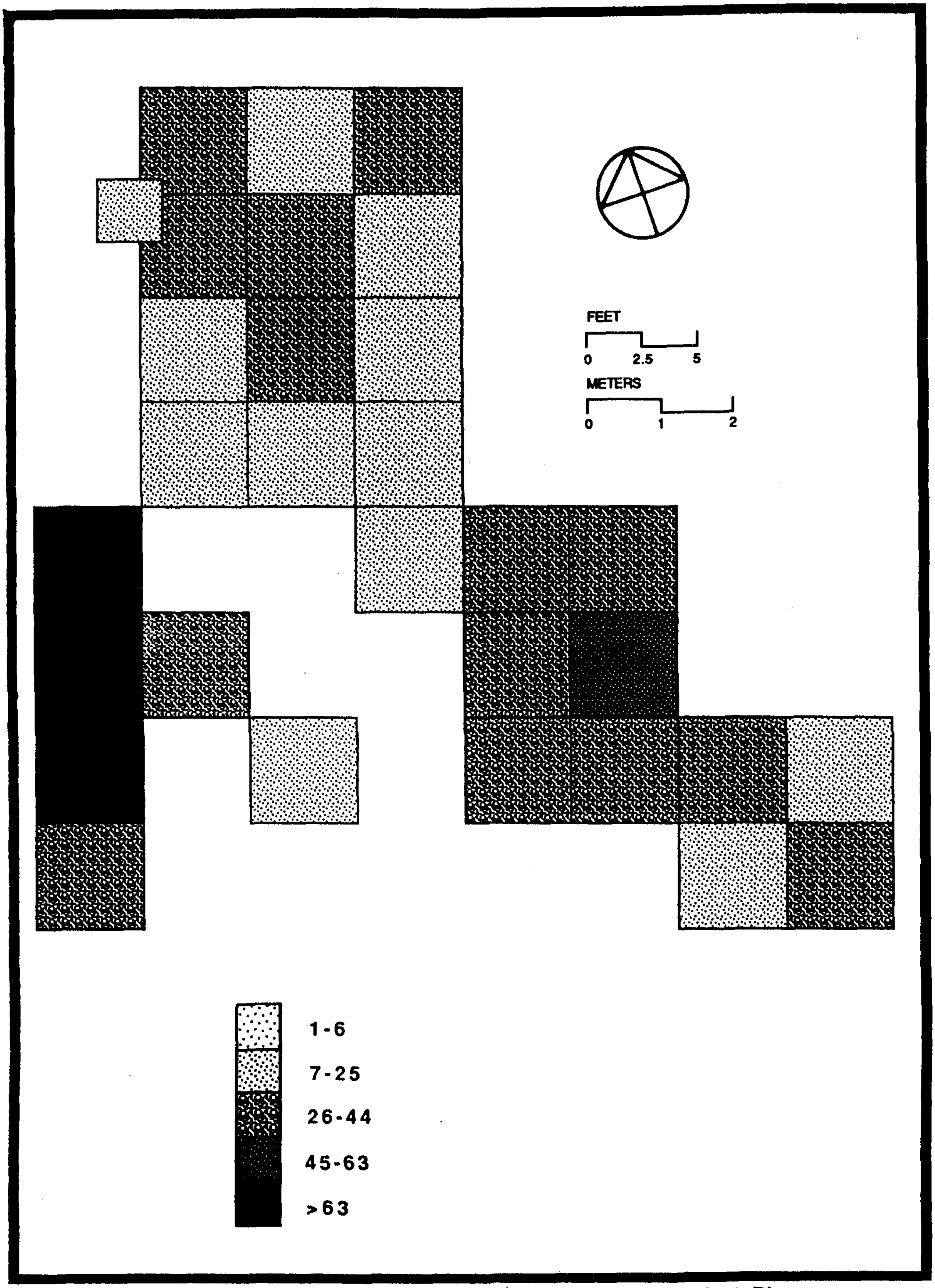


FIGURE 77: Distribution of Quartzite Debitage, Excavation Block 5 Plowzone

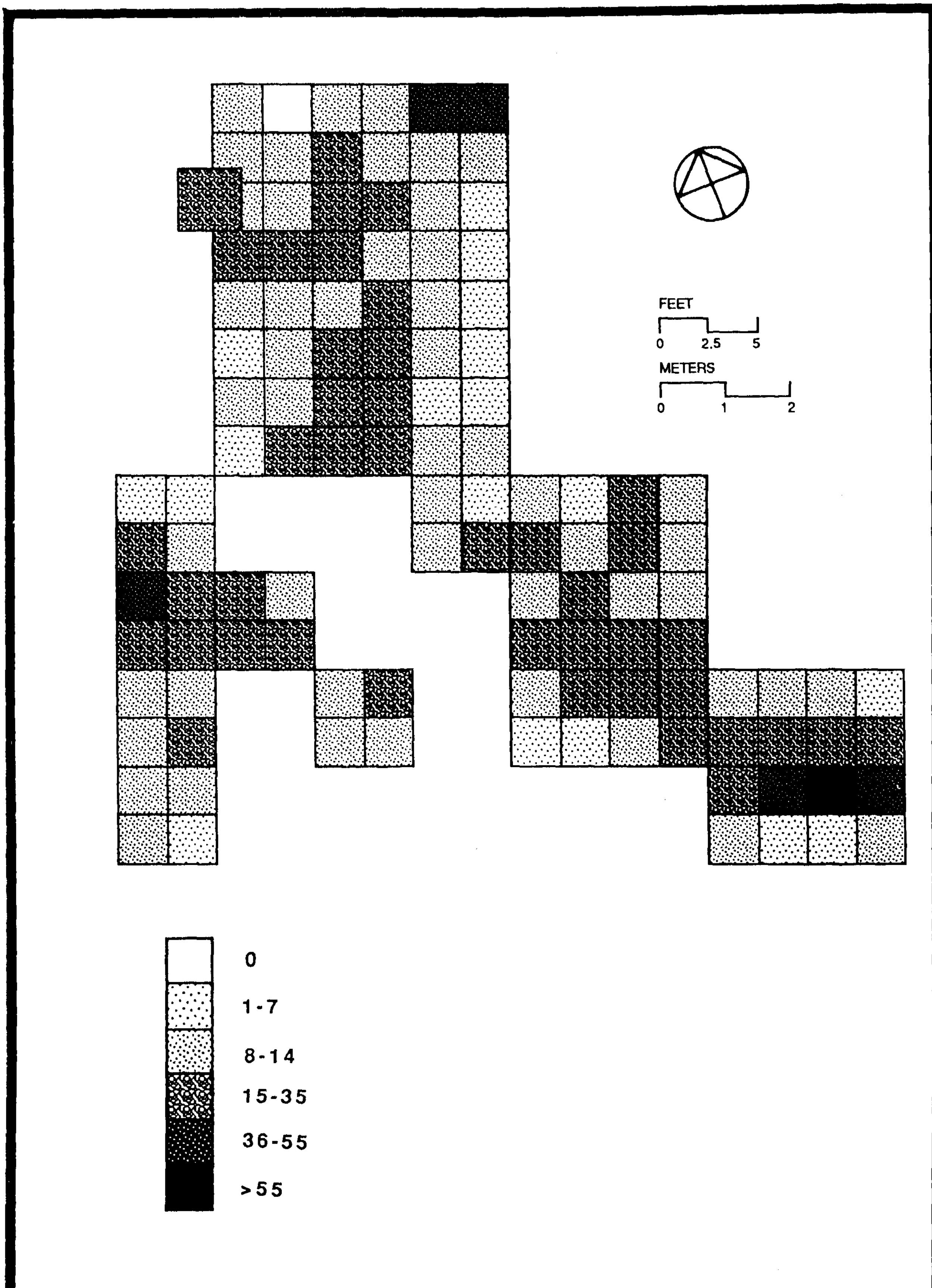


FIGURE 78: Distribution of Quartzite Debitage, Excavation Block 5 Subsoil

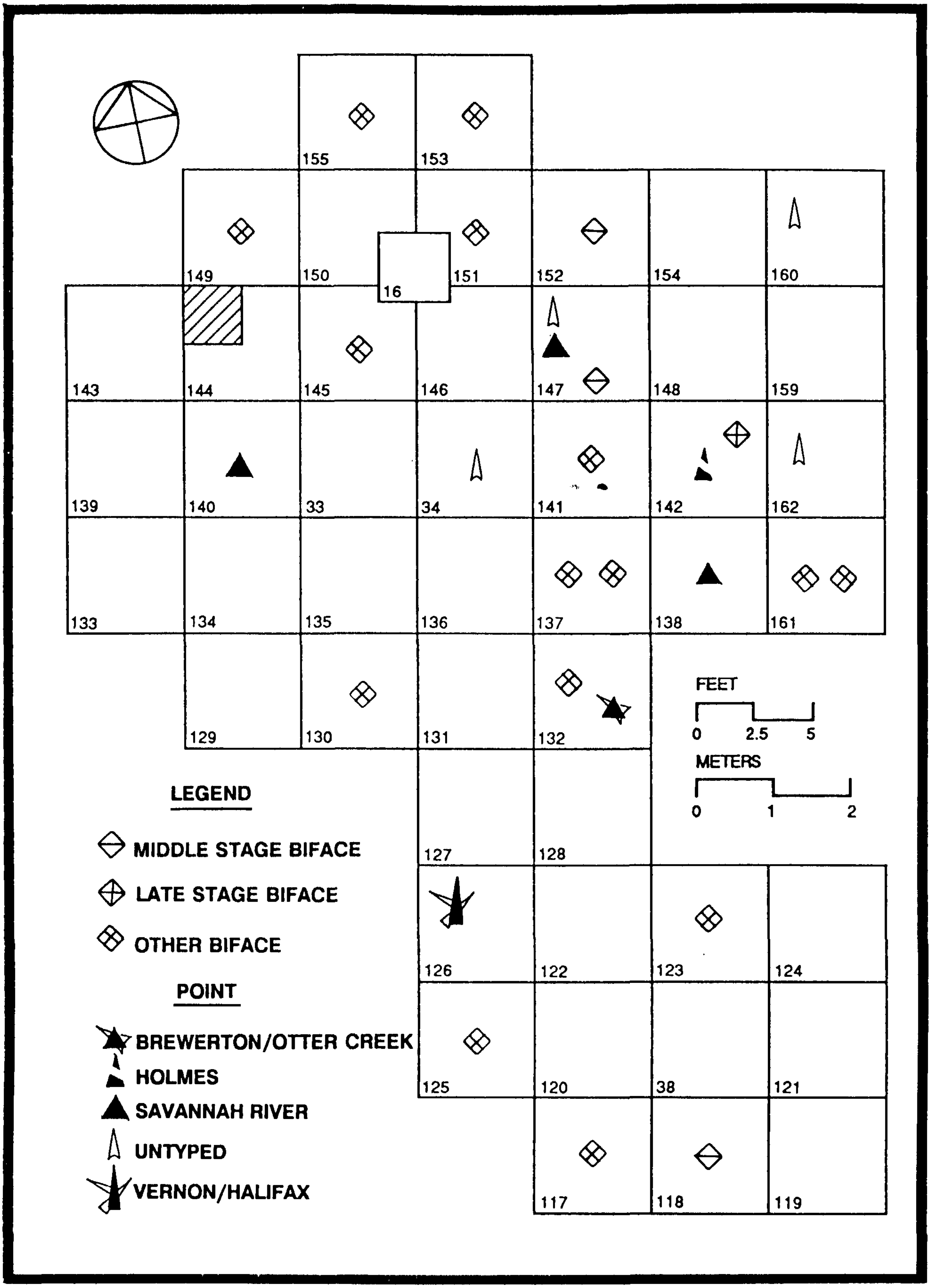


FIGURE 79: Distribution of Quartzite Tools, Excavation Block 6 Plowzone

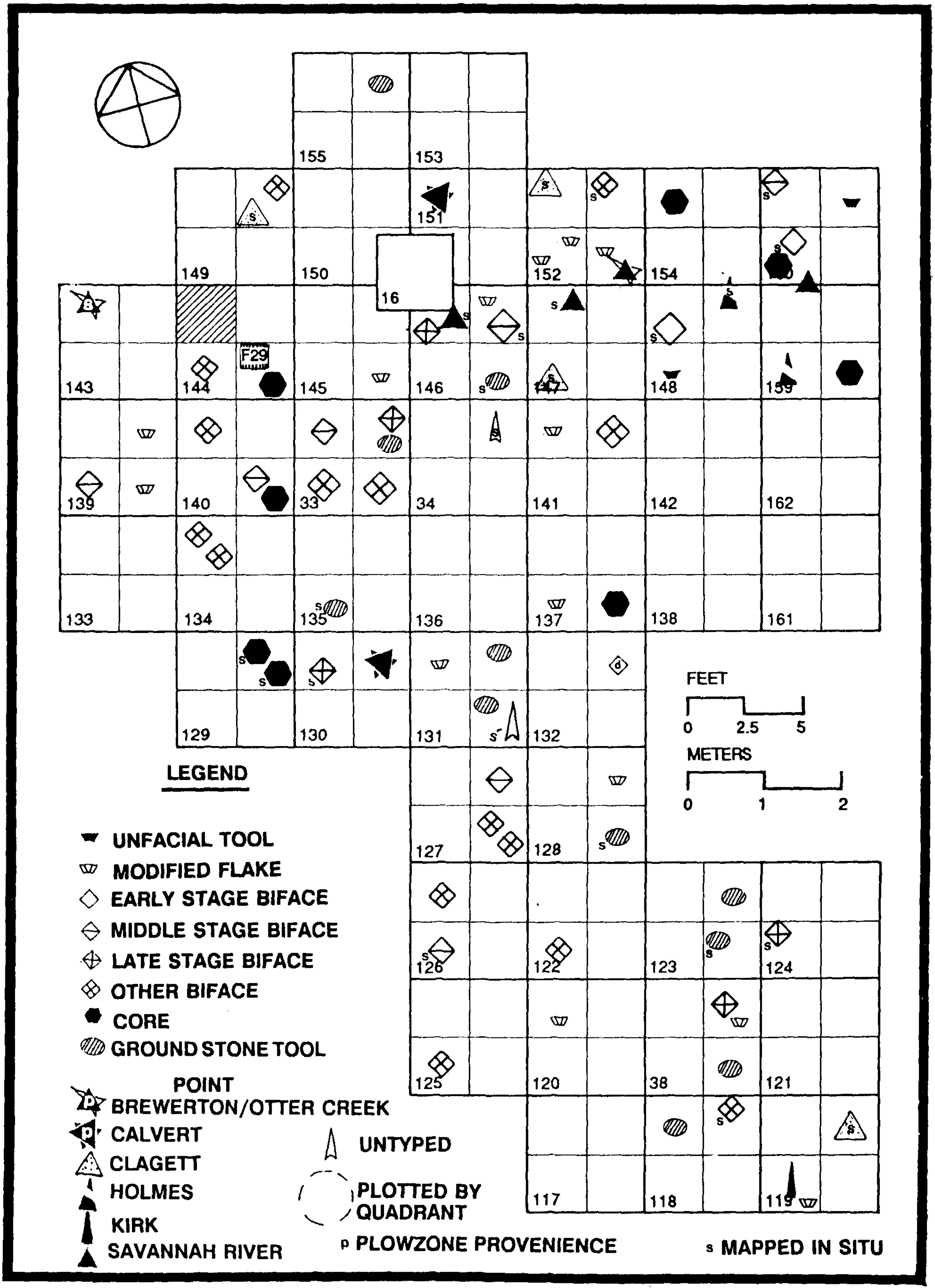


FIGURE 80: Distribution of Quartzite Tools, Excavation Block 6 Subsoil

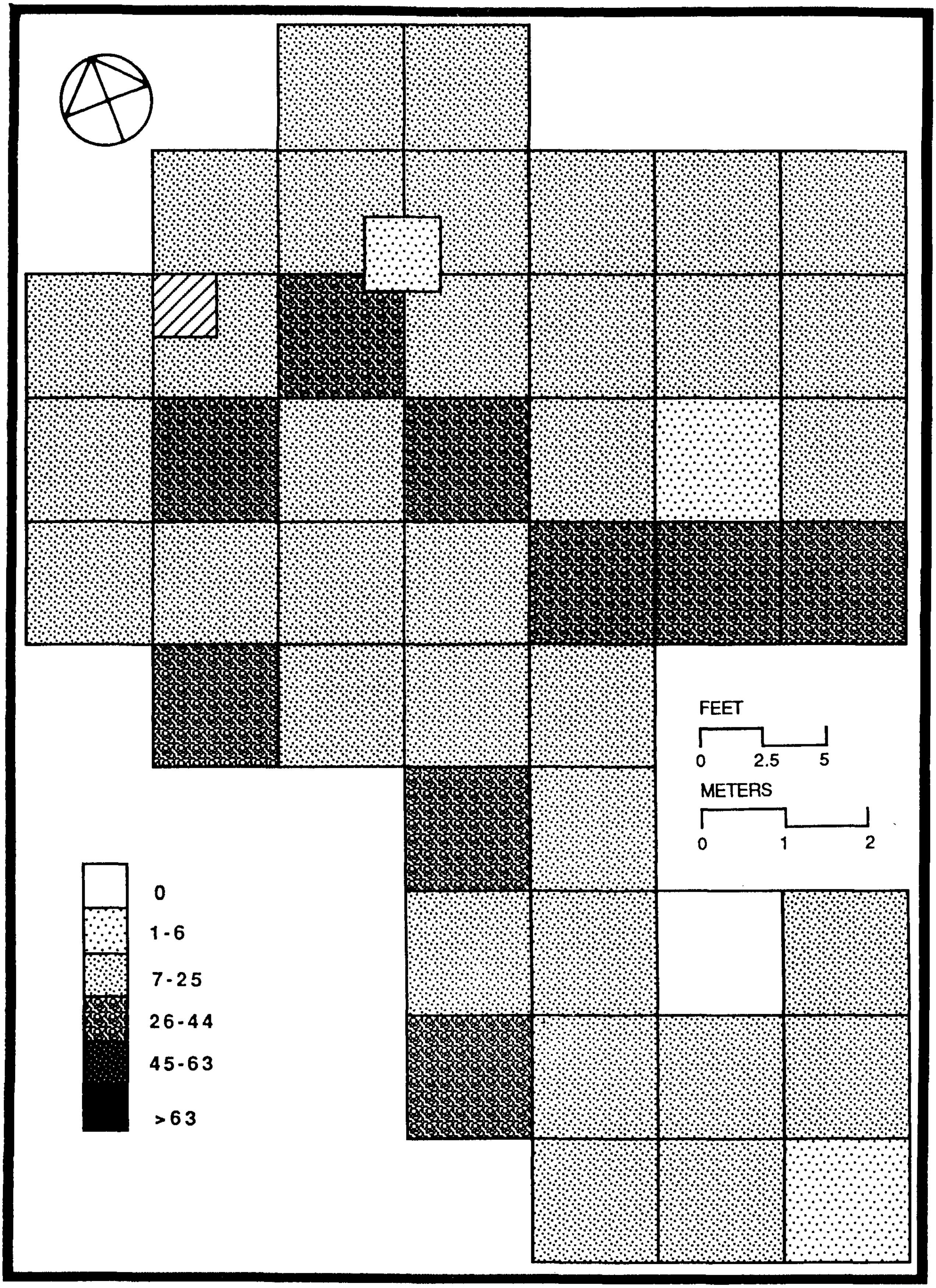


FIGURE 81: Distribution of Quartzite Debitage, Excavation Block 6 Plowzone

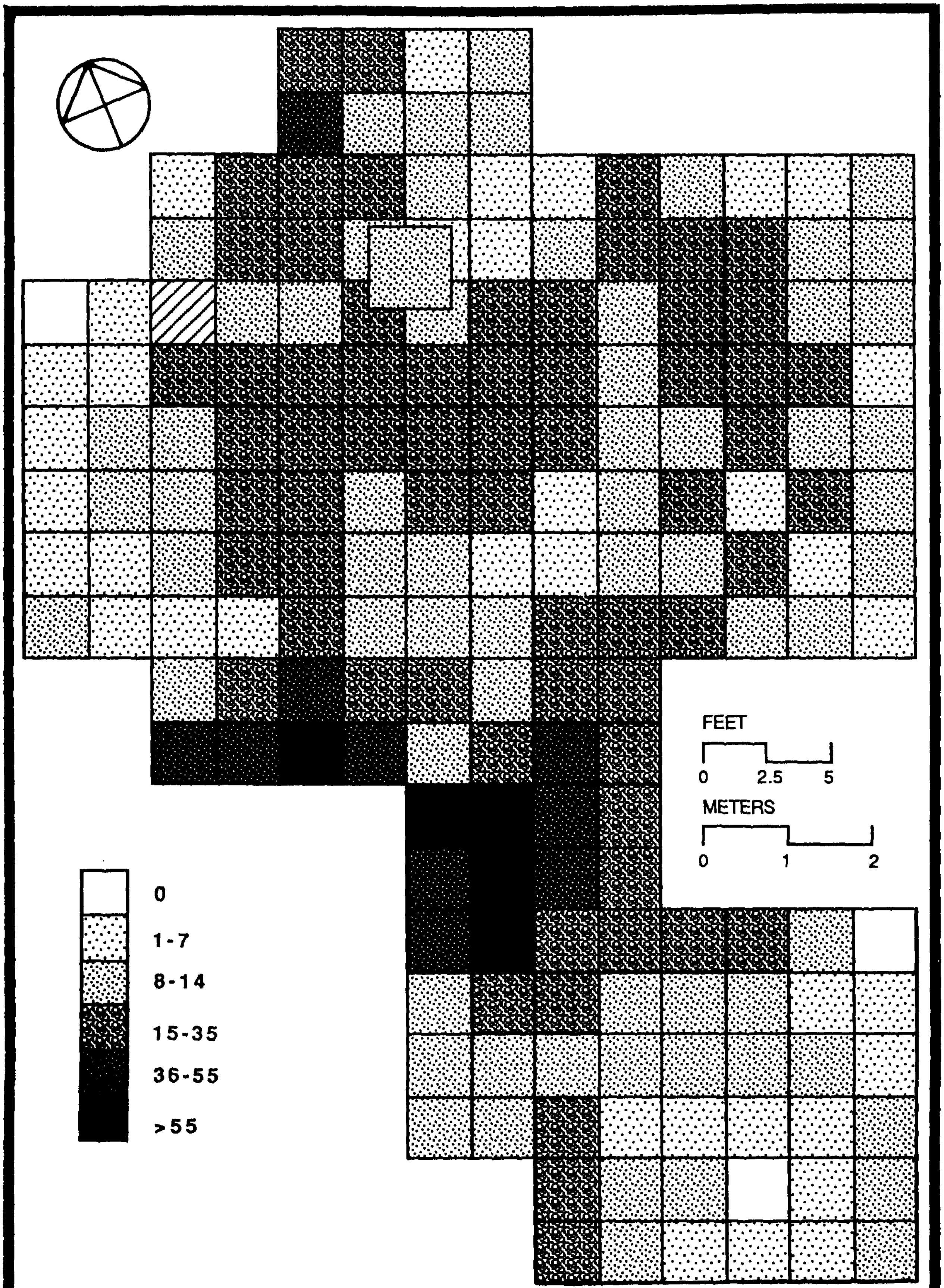


FIGURE 82: Distribution of Quartzite Debitage, Excavation Block 6 Subsoil

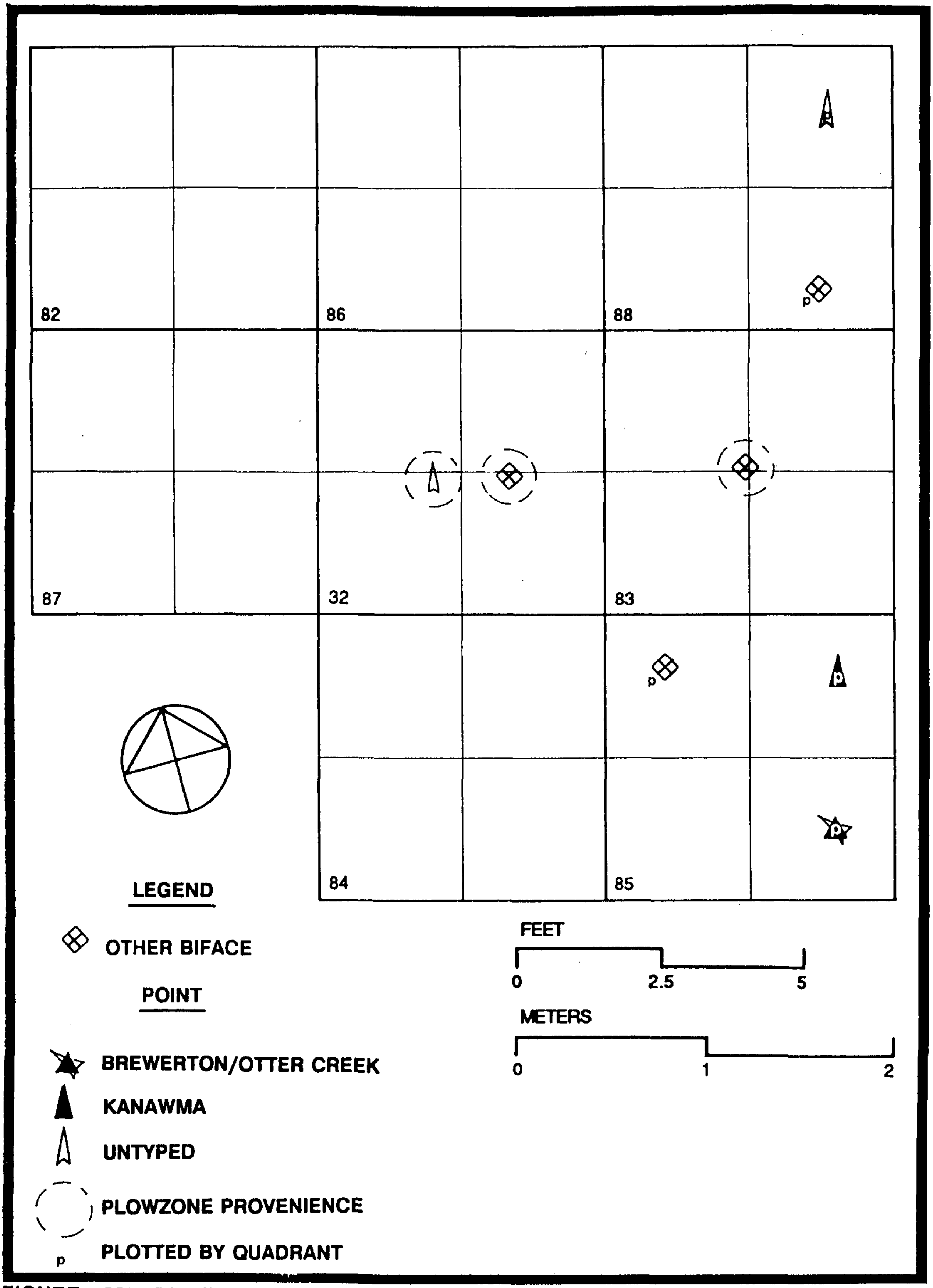


FIGURE 83: Distribution of Rhyolite Tools, Excavation Block 2

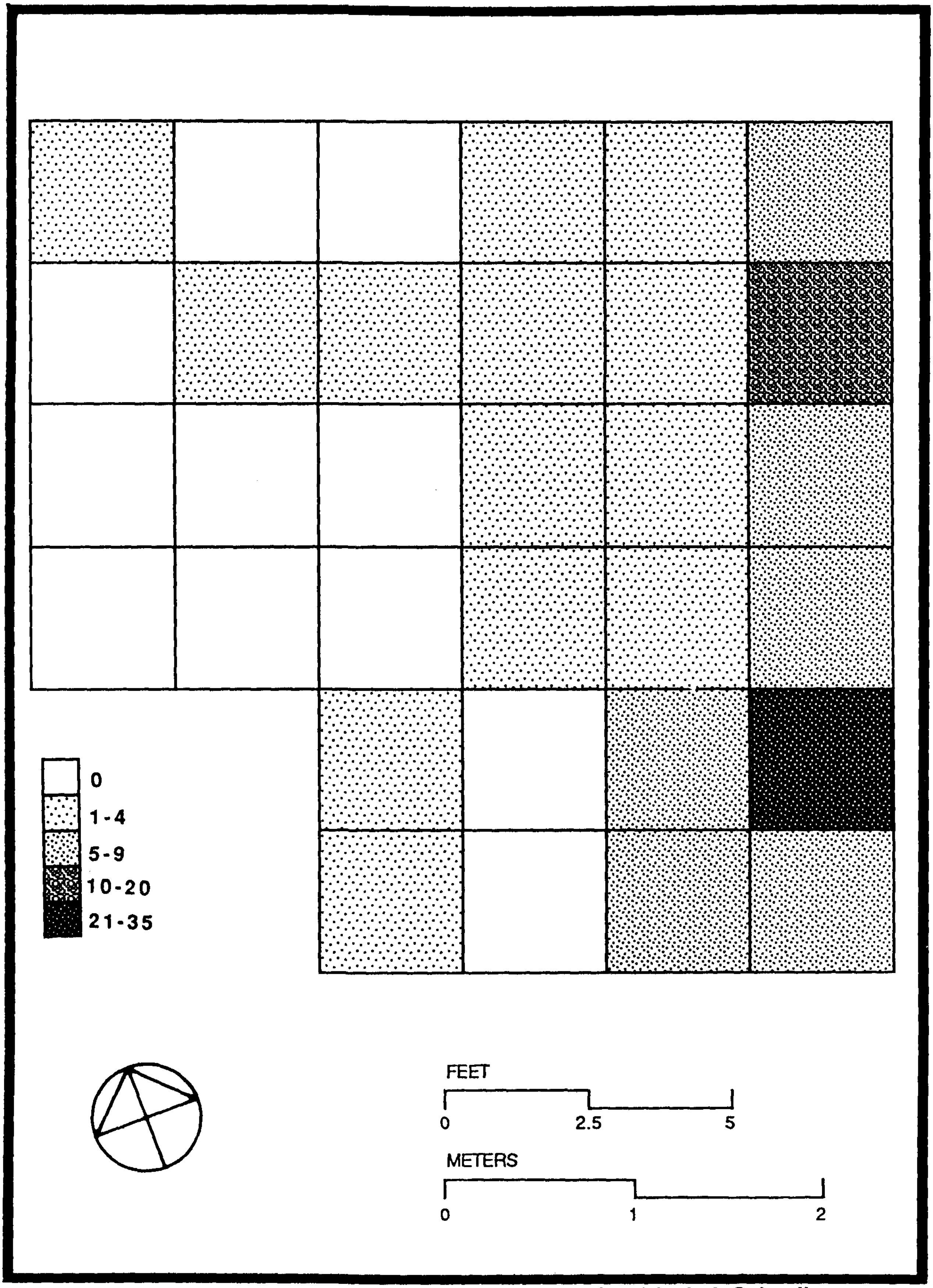


FIGURE 84: Distribution of Rhyolite Debitage, Excavation Block 2 Subsoil

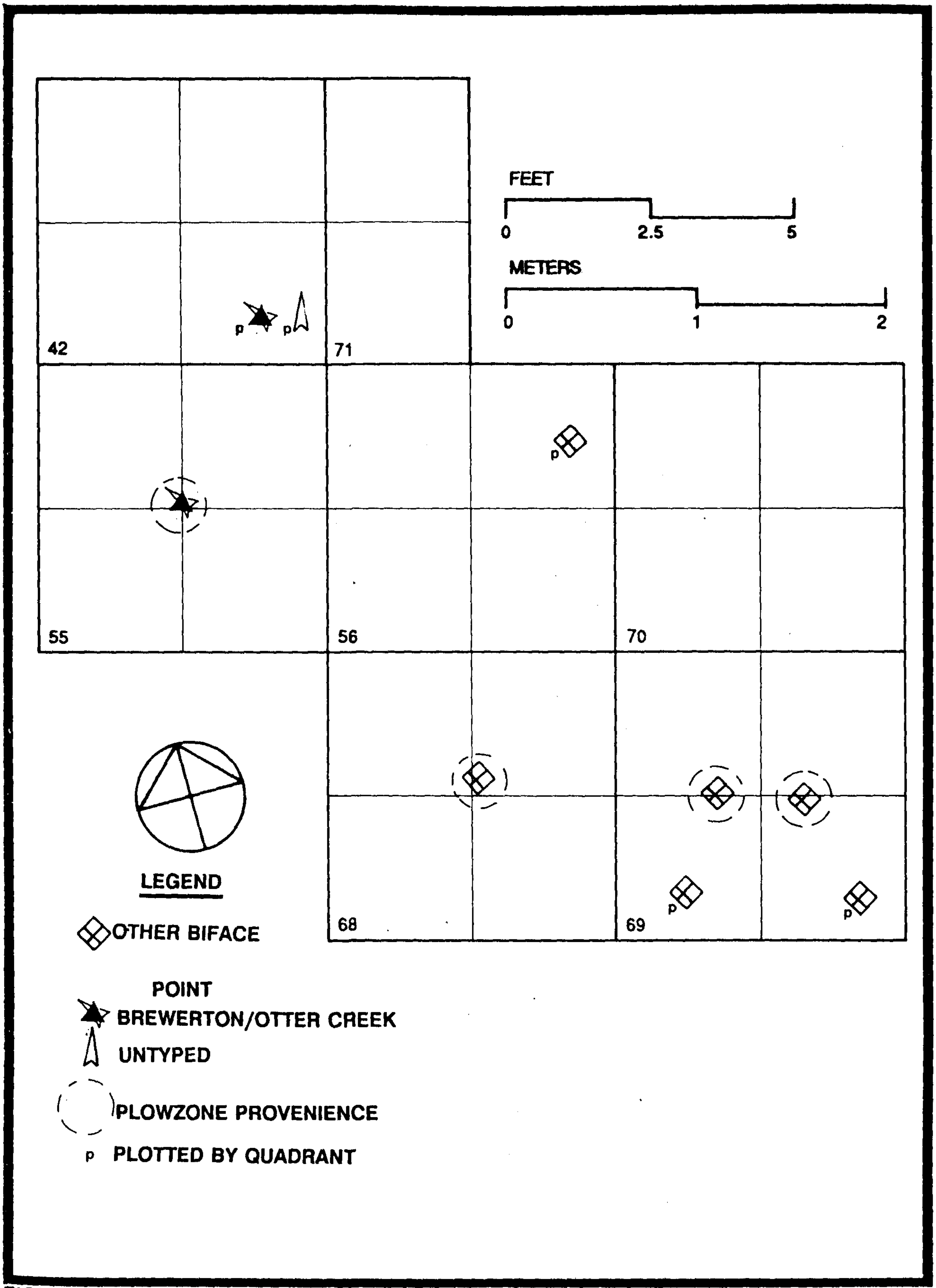


FIGURE 85: Distribution of Rhyolite Tools, Excavation Block 3

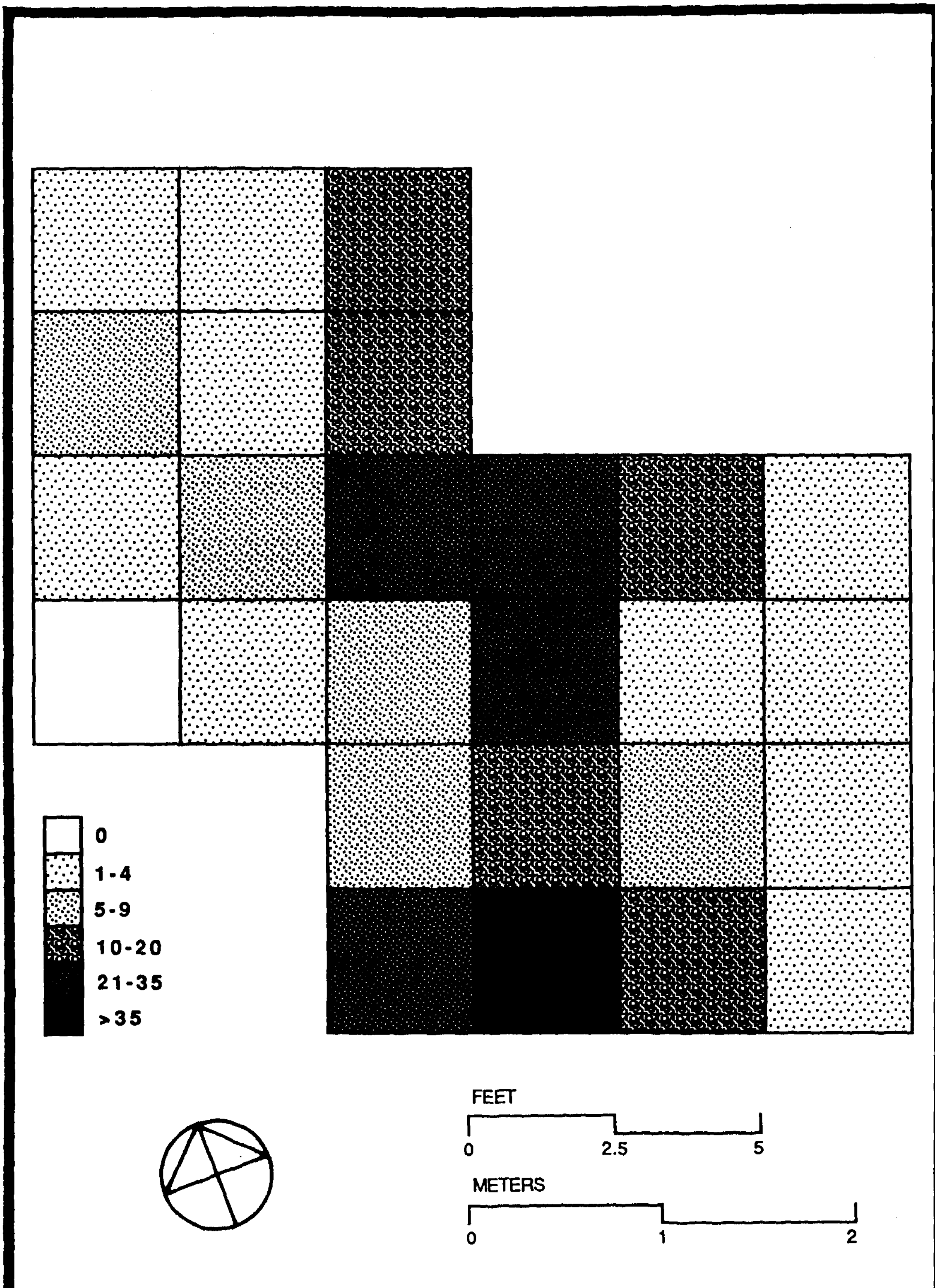


FIGURE 86: Distribution of Rhyolite Debitage, Excavation Block 3 Subsoil

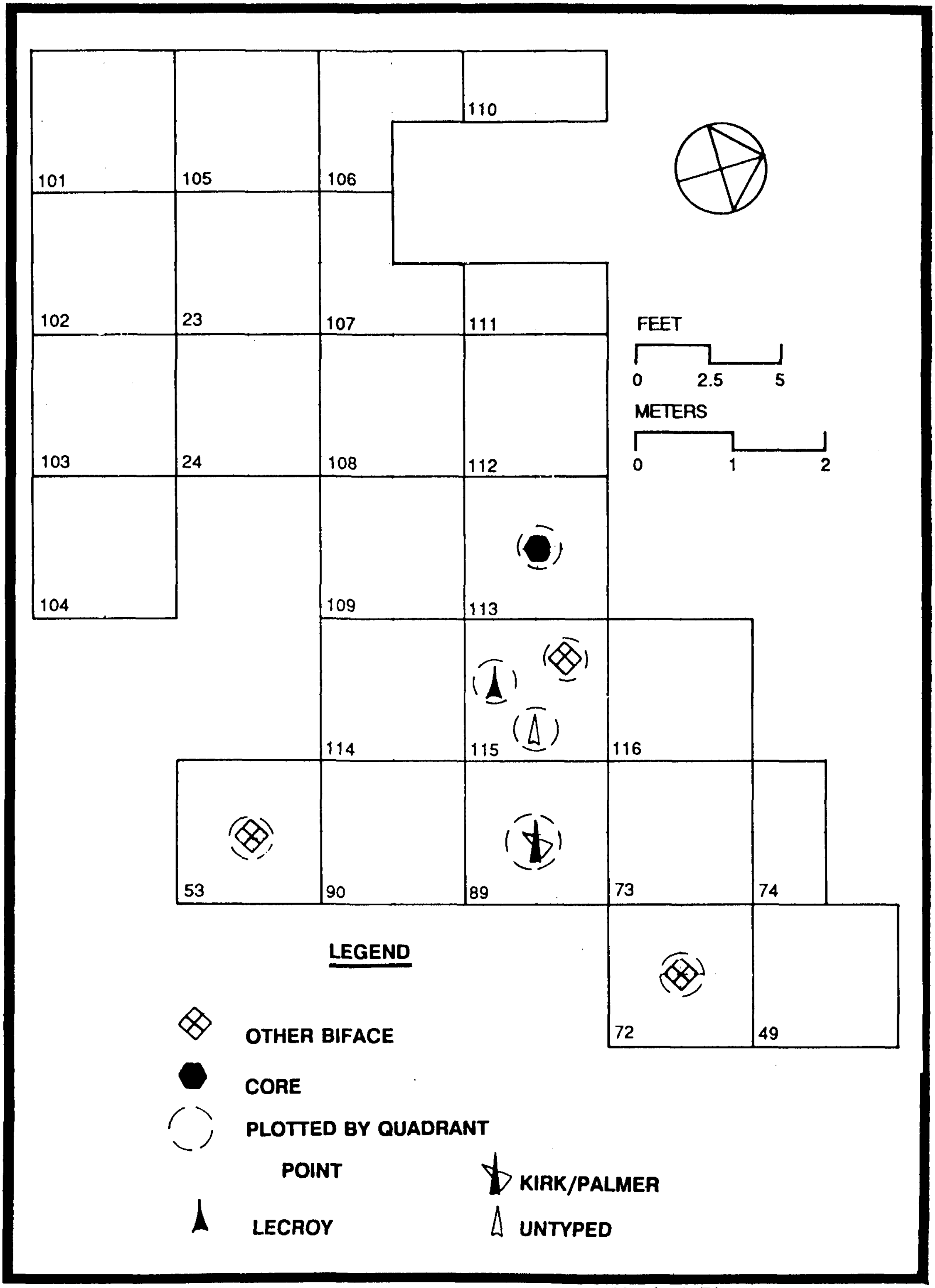


FIGURE 87: Distribution of Rhyolite Tools, Excavation Block 4 Plowzone

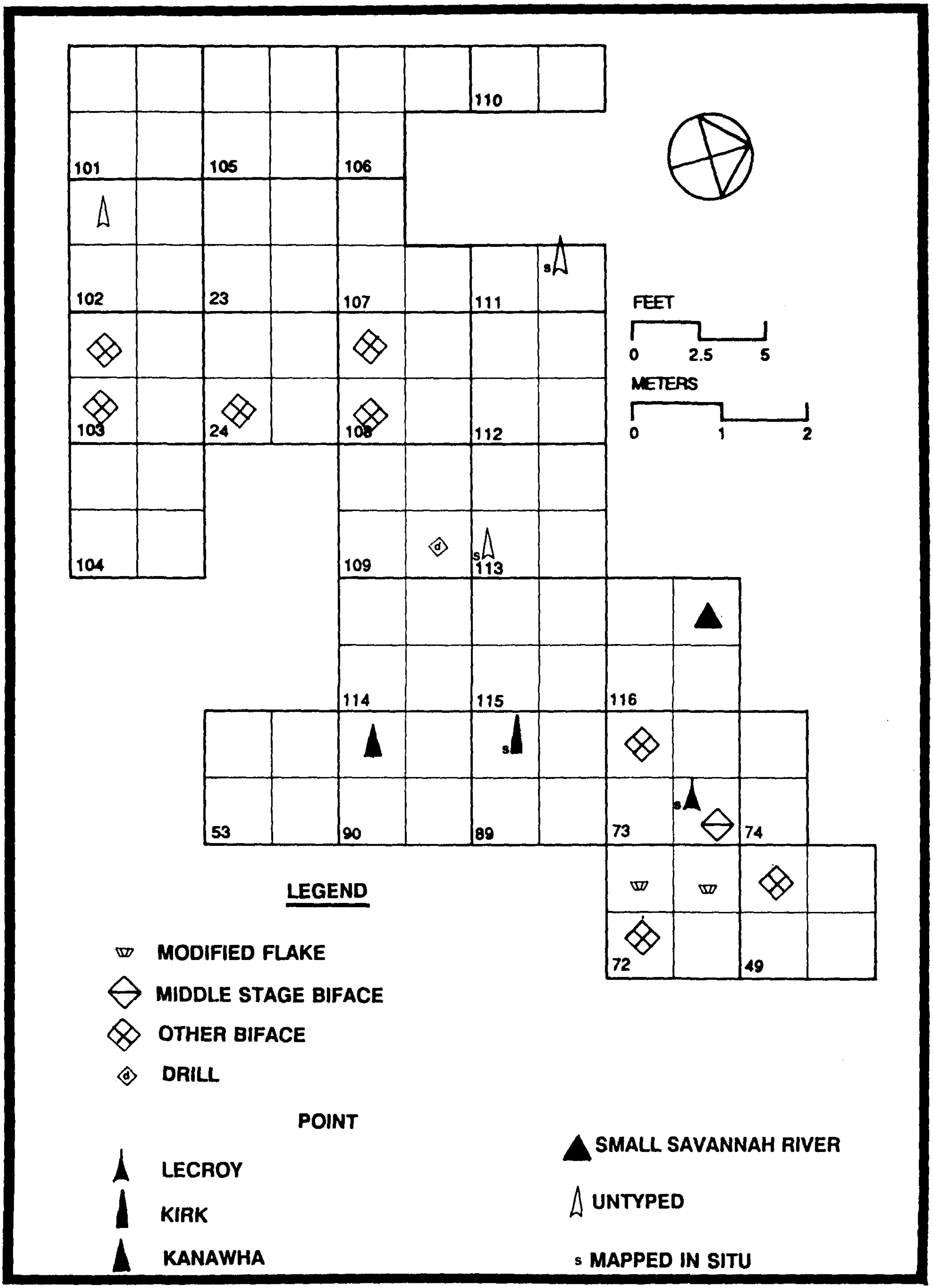


FIGURE 88: Distribution of Rhyolite Tools, Excavation Block 4 Subsoil

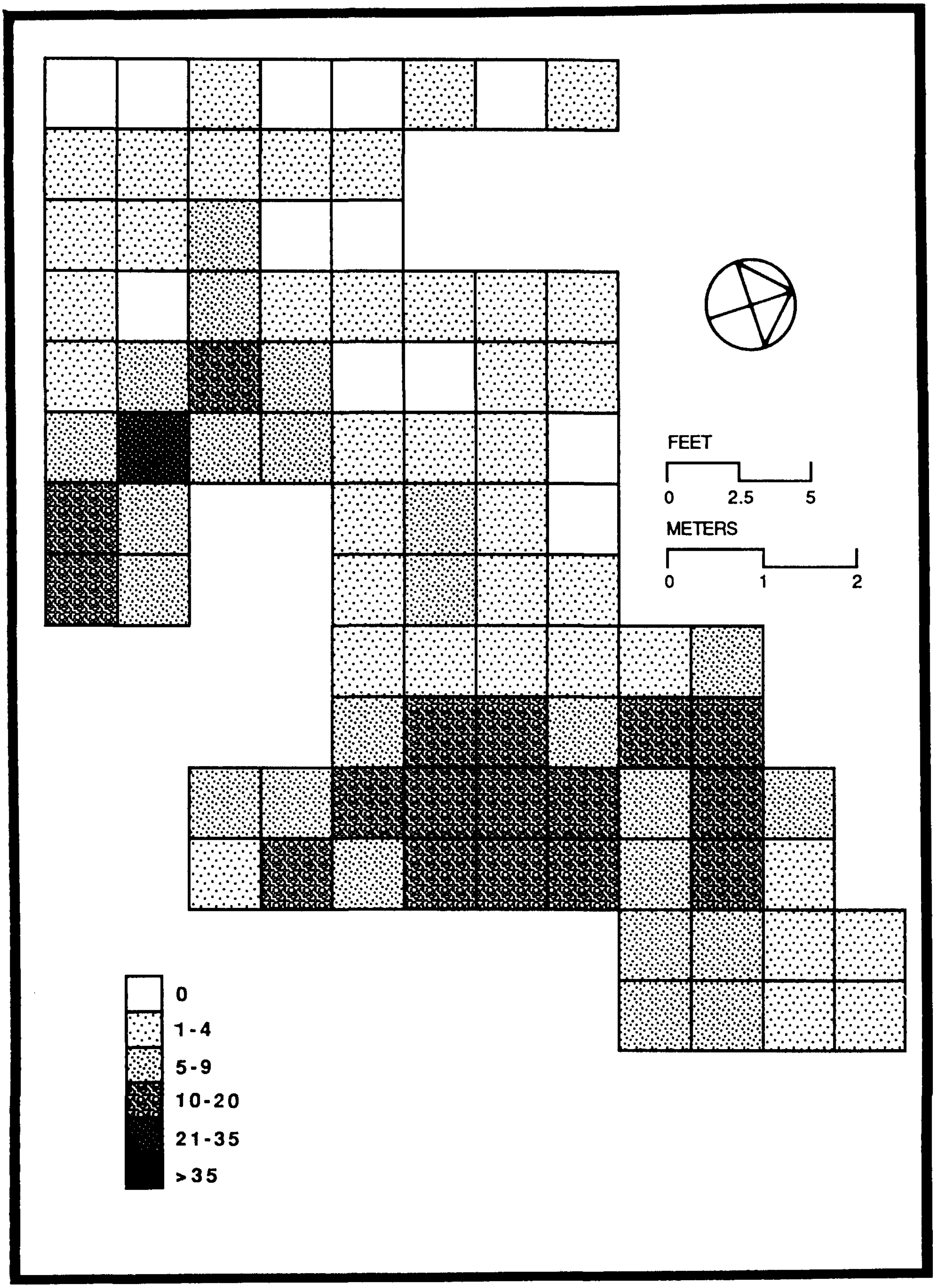


FIGURE 89: Distribution of Rhyolite Debitage, Excavation Block 4 Subsoil

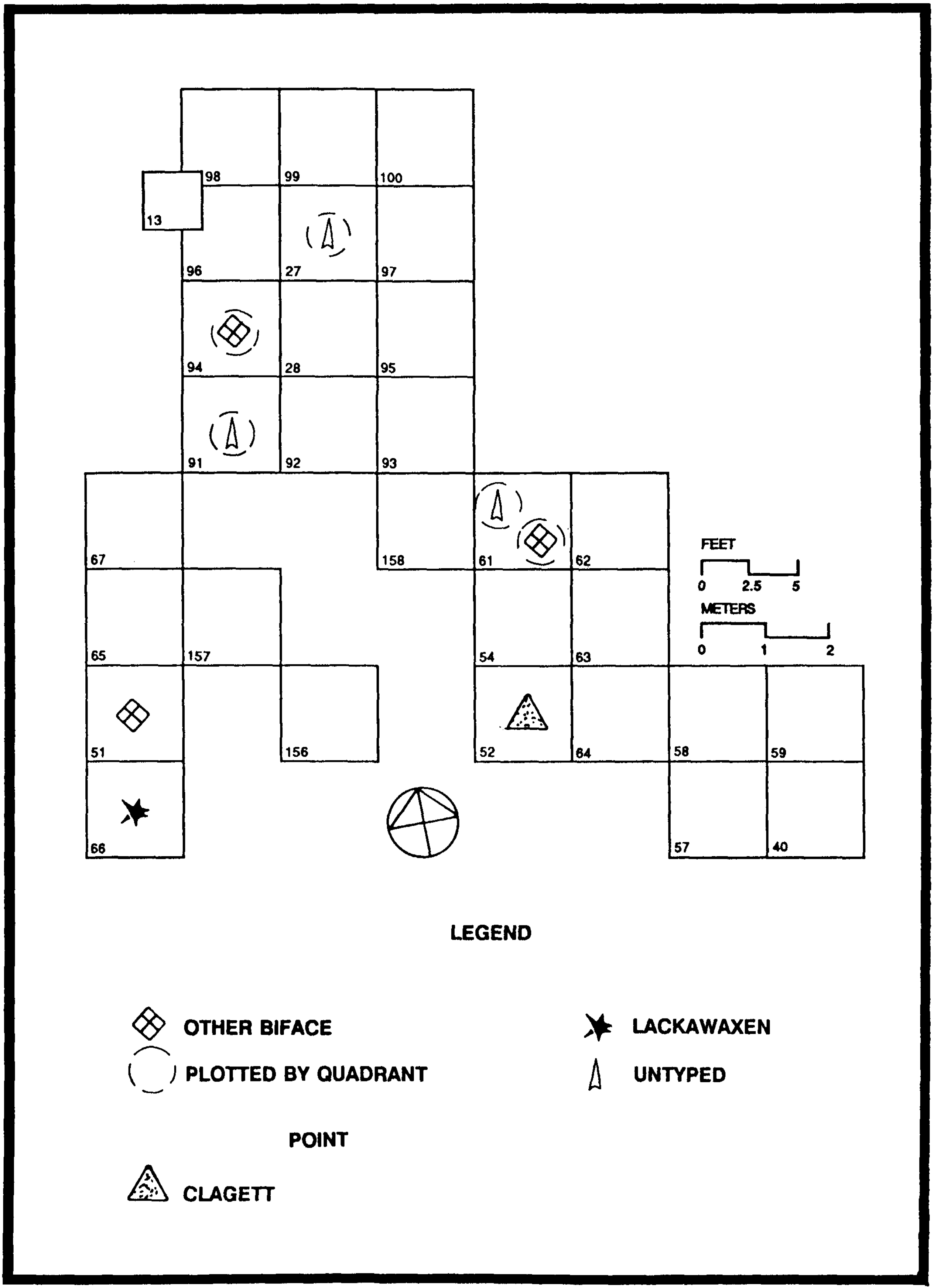


FIGURE 90: Distribution of Rhyolite Tools, Excavation Block 5 Plowzone

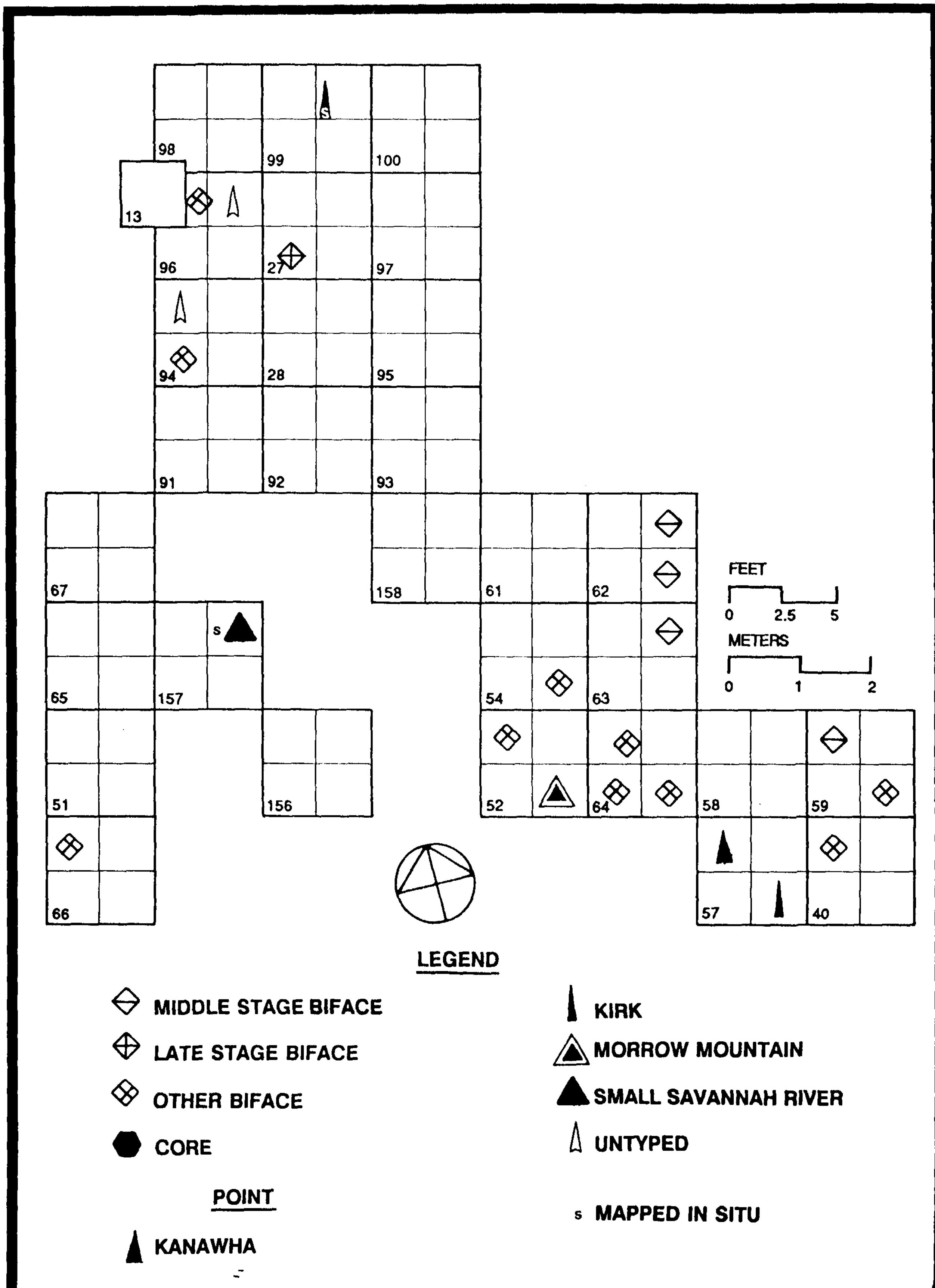


FIGURE 91: Distribution of Rhyolite Tools, Excavation Block 5 Subsoil

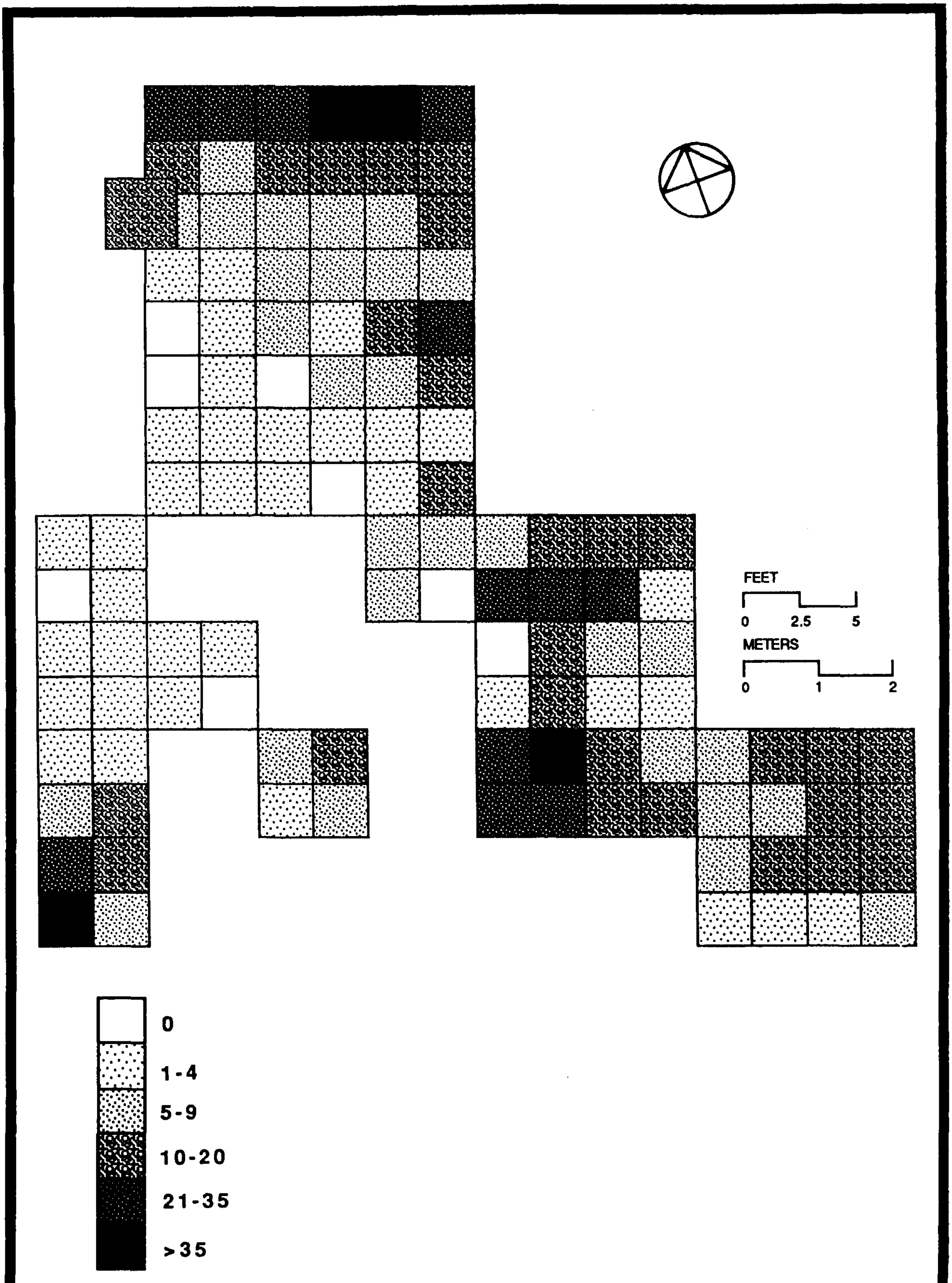


FIGURE 92: Distribution of Rhyolite Debitage, Excavation Block 5 Subsoil

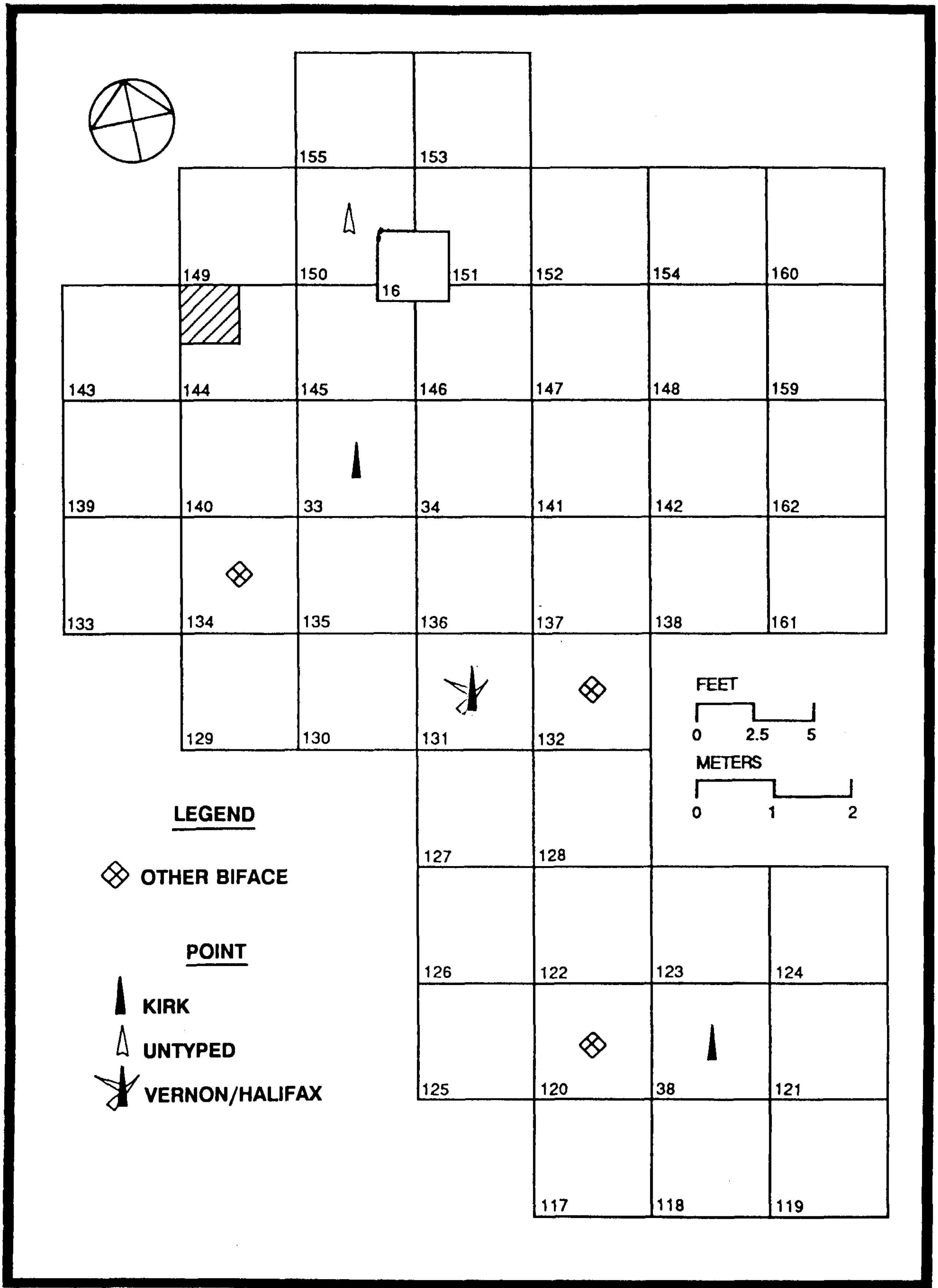


FIGURE 93: Distribution of Rhyolite Tools, Excavation Block 6 Plowzone

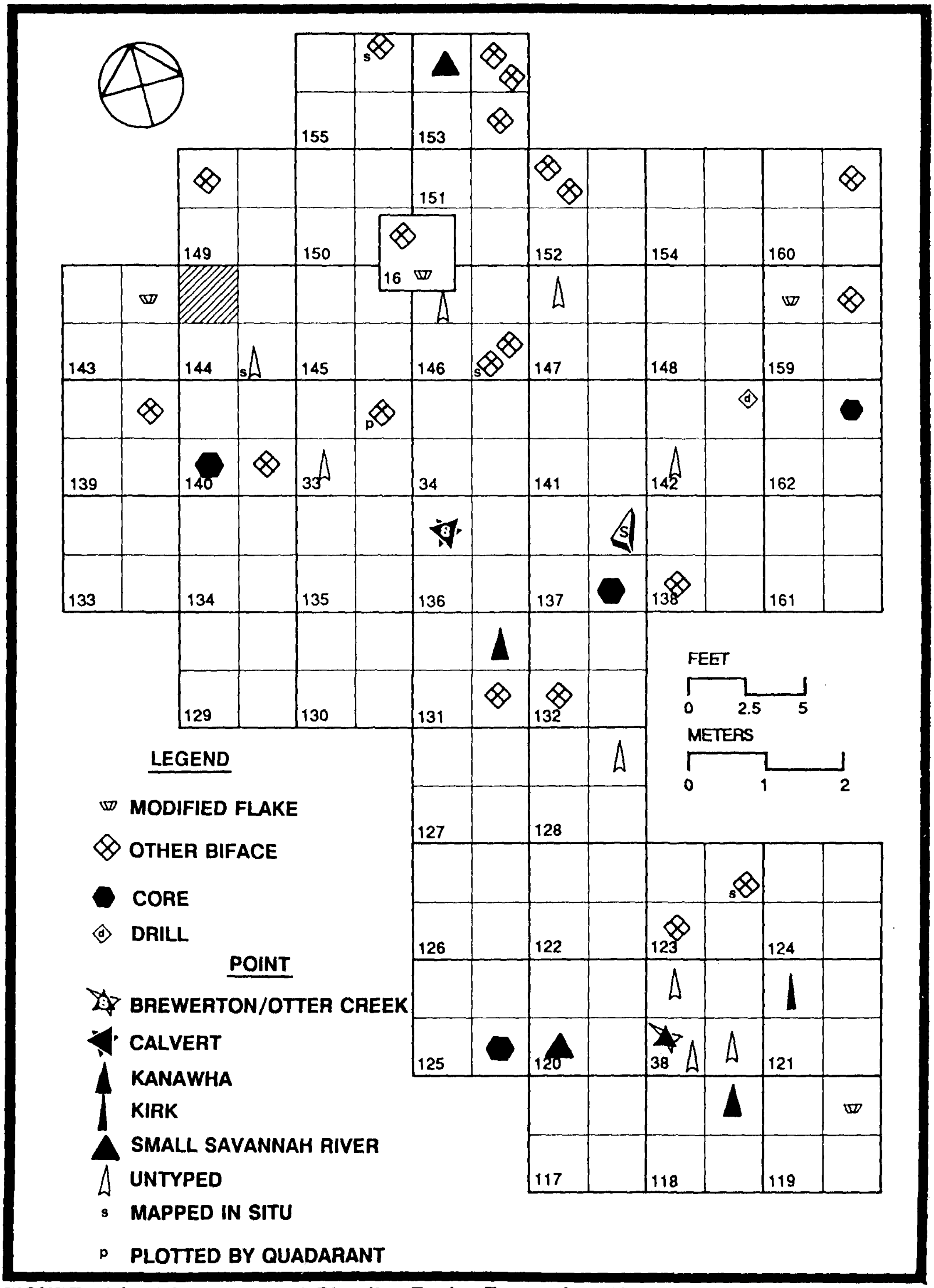


FIGURE 94: Distribution of Rhyolite Tools, Excavation Block 6 Subsoil

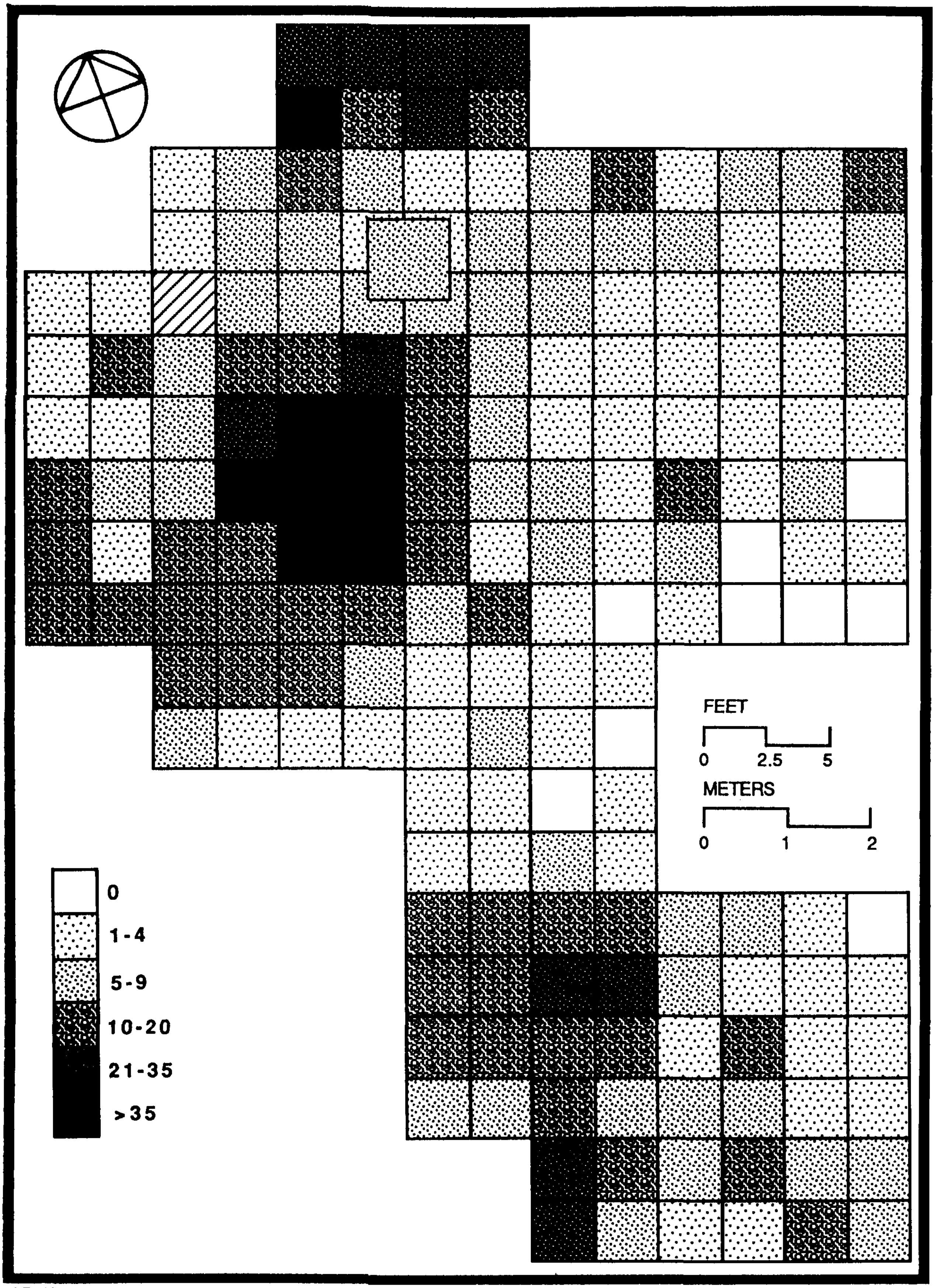


FIGURE 95: Distribution of Rhyolite Debitage, Excavation Block 6 Subsoil

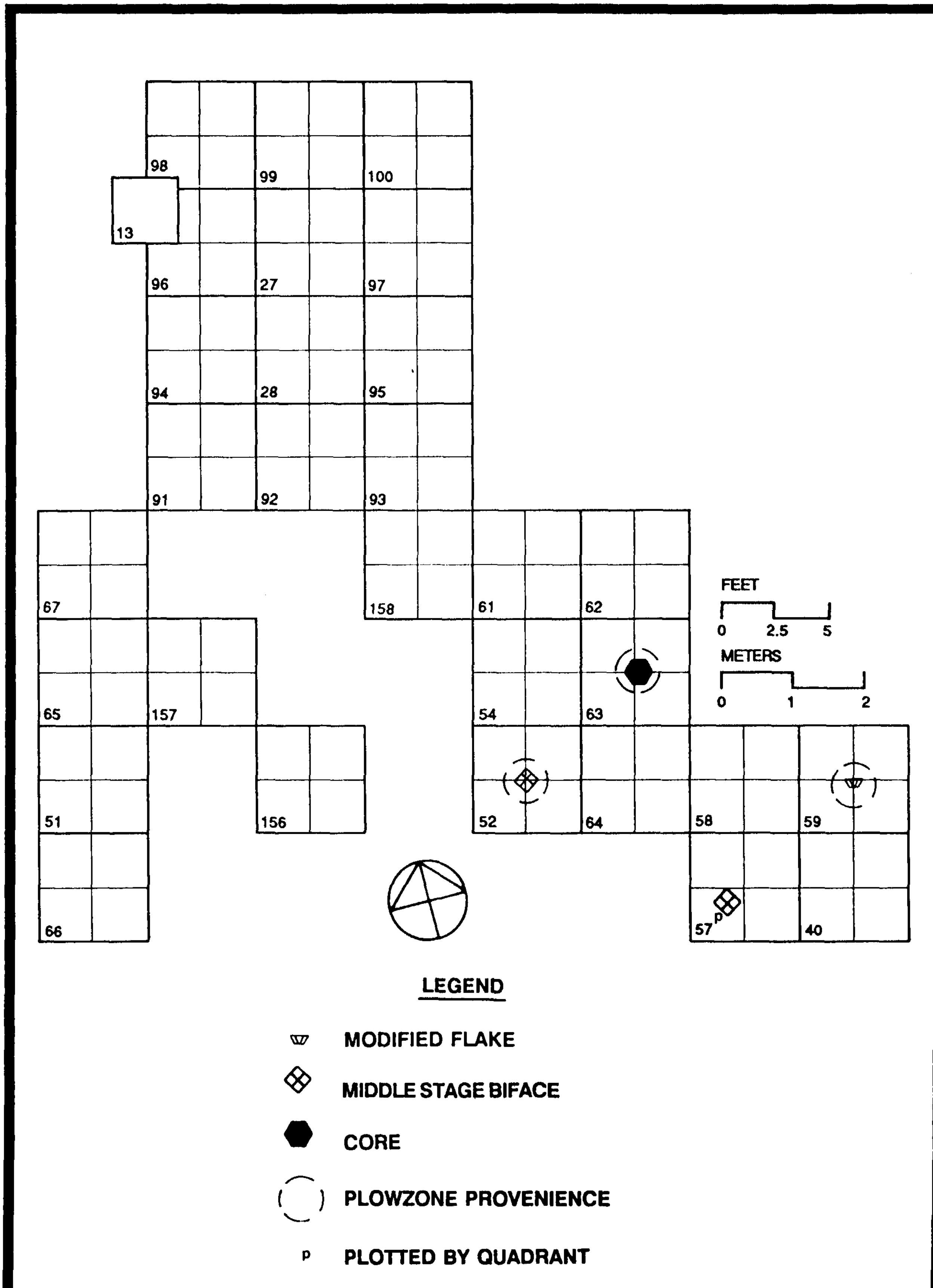


FIGURE 96: Distribution of Sandy Chert Tools, Excavation Block 5

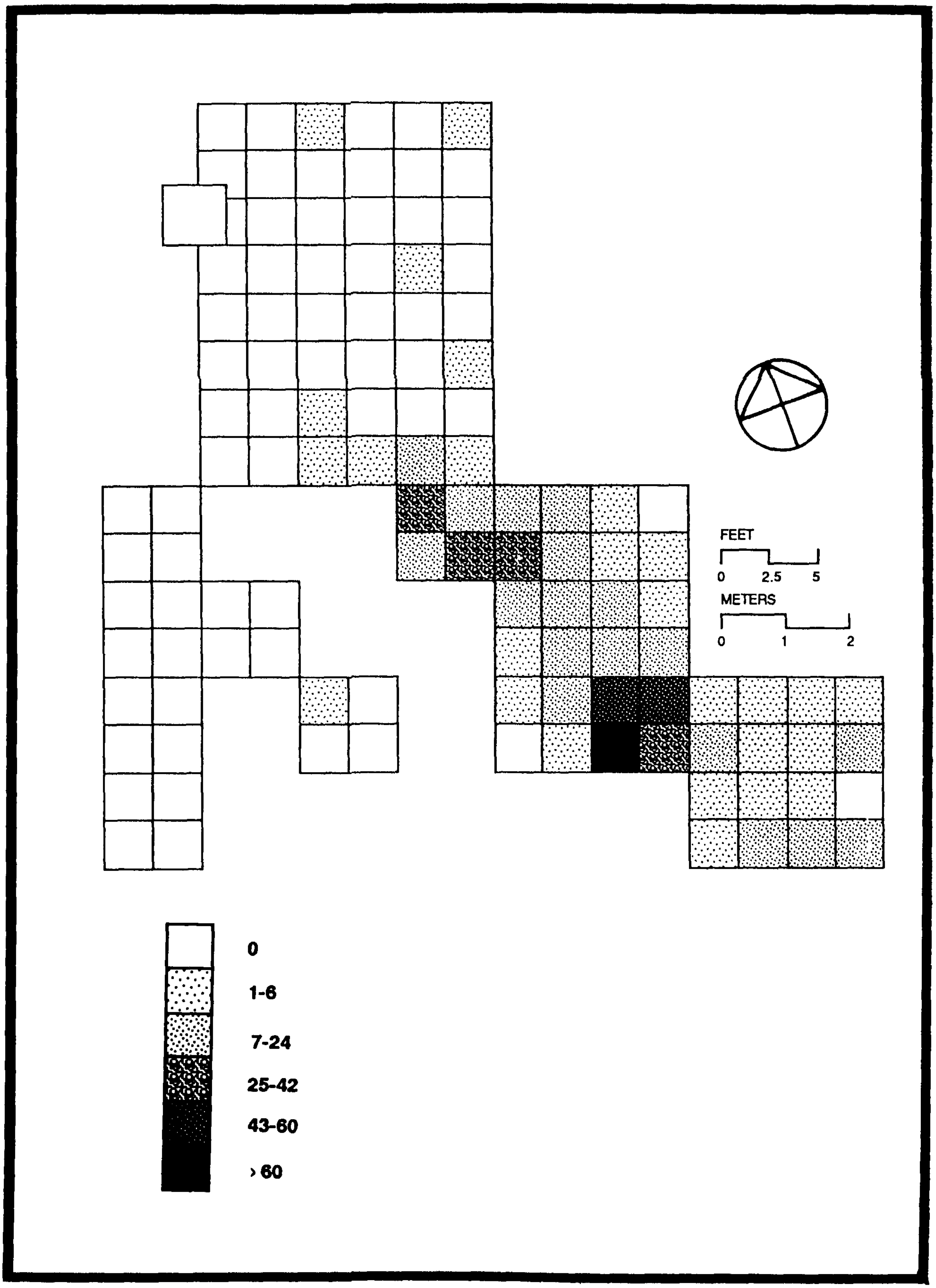


FIGURE 97: Distribution of Sandy Chert Debitage, Excavation Block 5 Subsoil

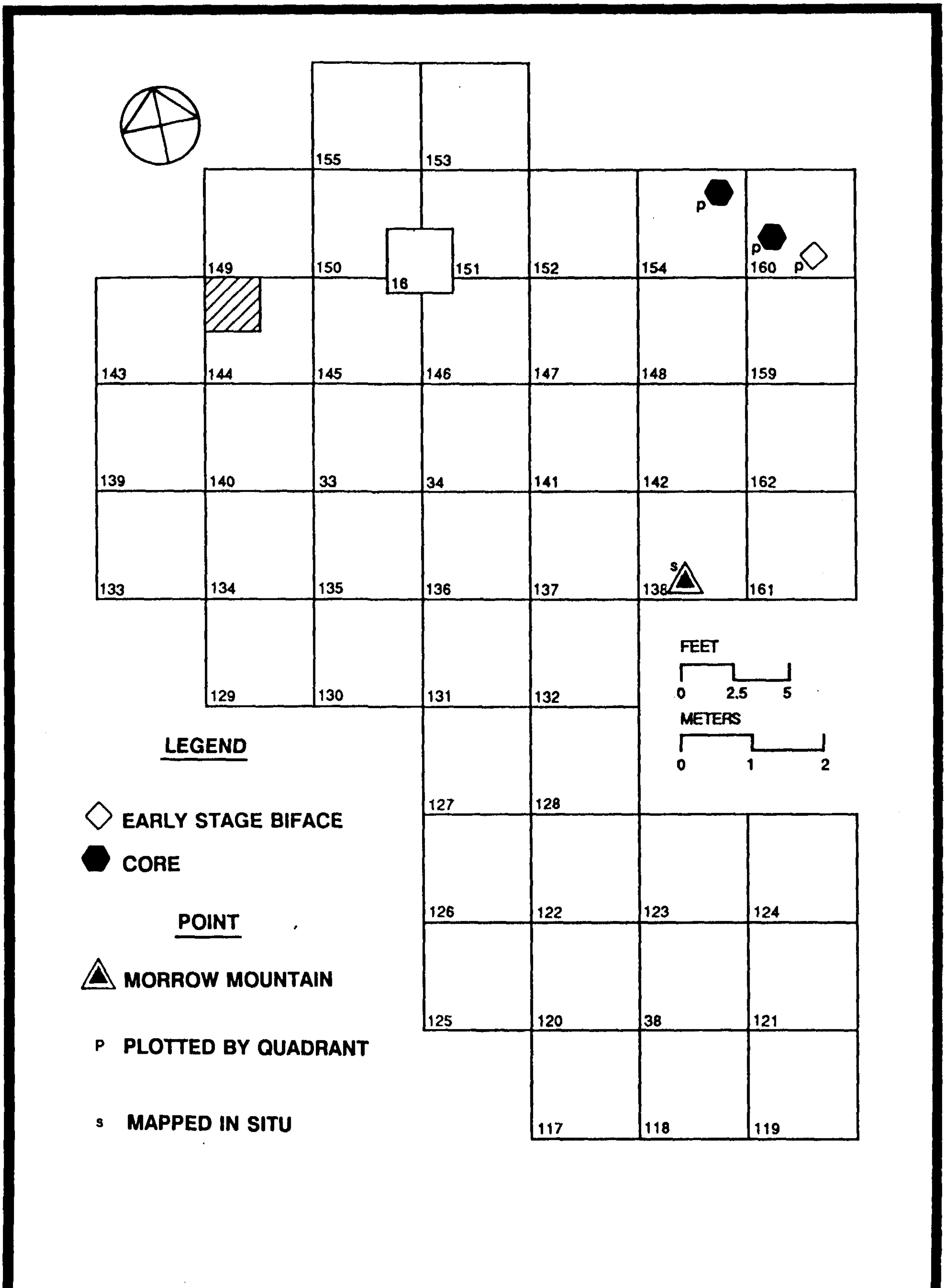


FIGURE 98: Distribution of Sandy Chert Tools, Excavation Block 6

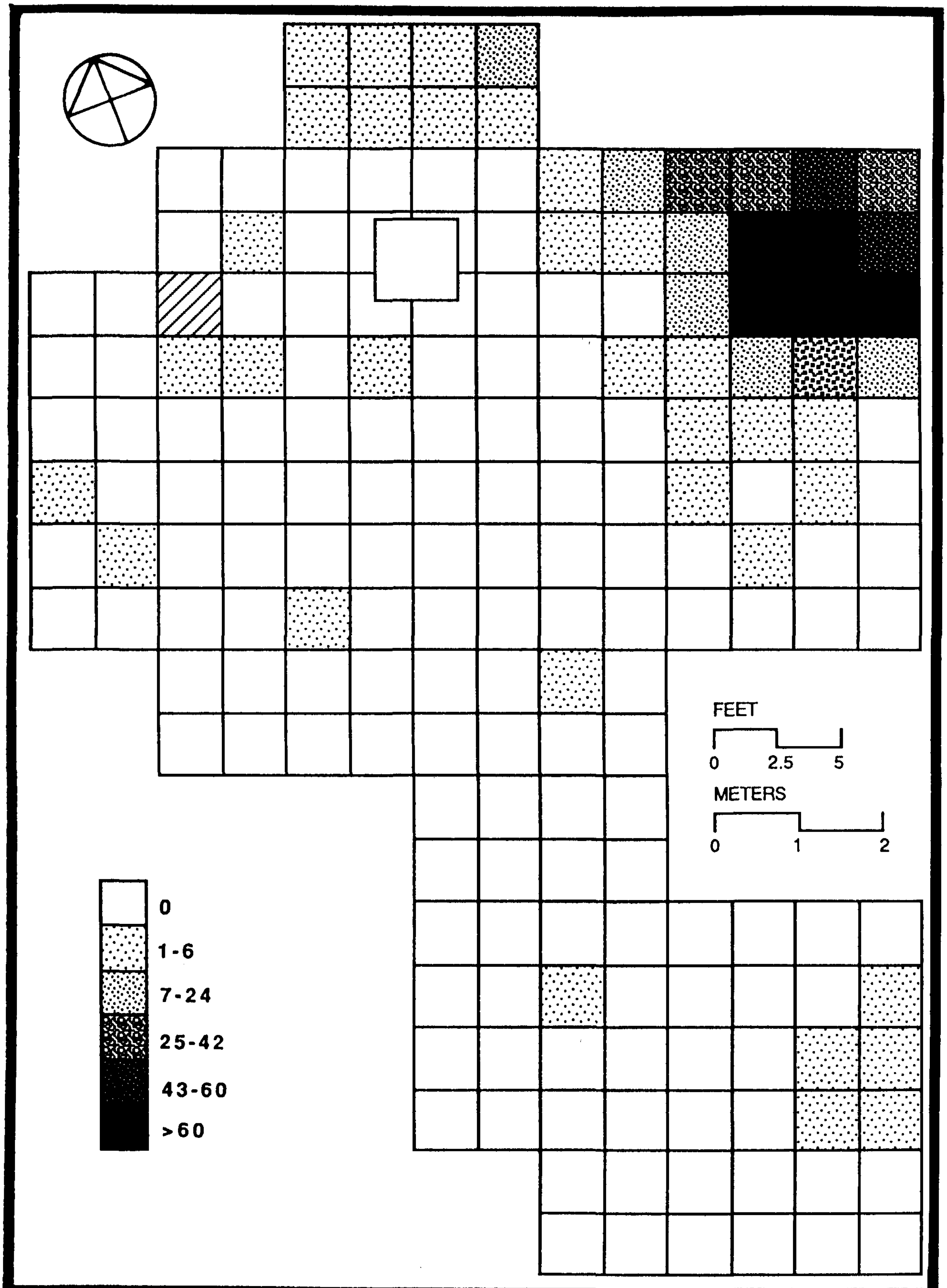


FIGURE 99: Distribution of Sandy Chert Debitage, Excavation Block 6 Subsoil

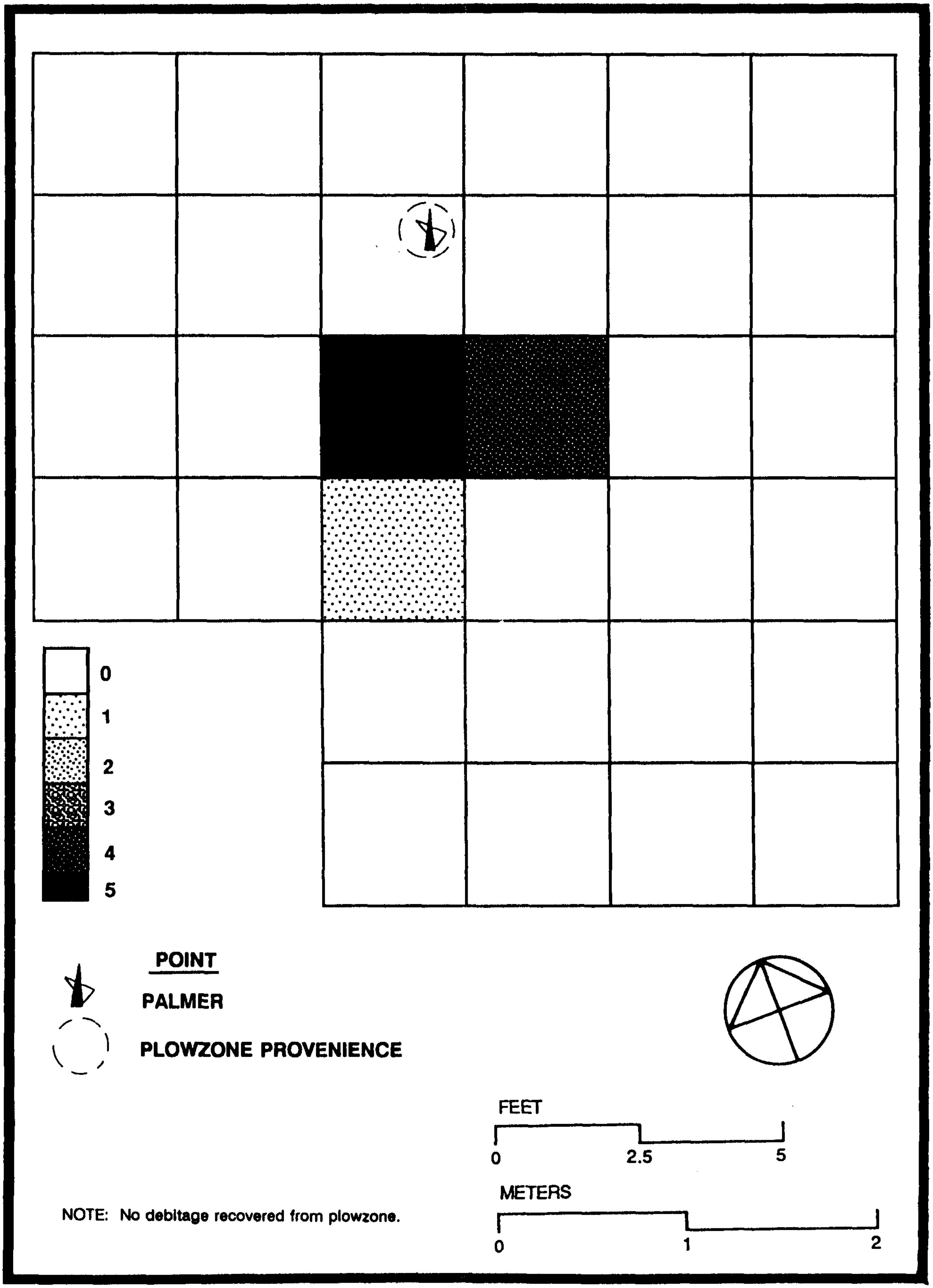


FIGURE 100: Distribution of Chert Tools and Debitage, Excavation Block 2

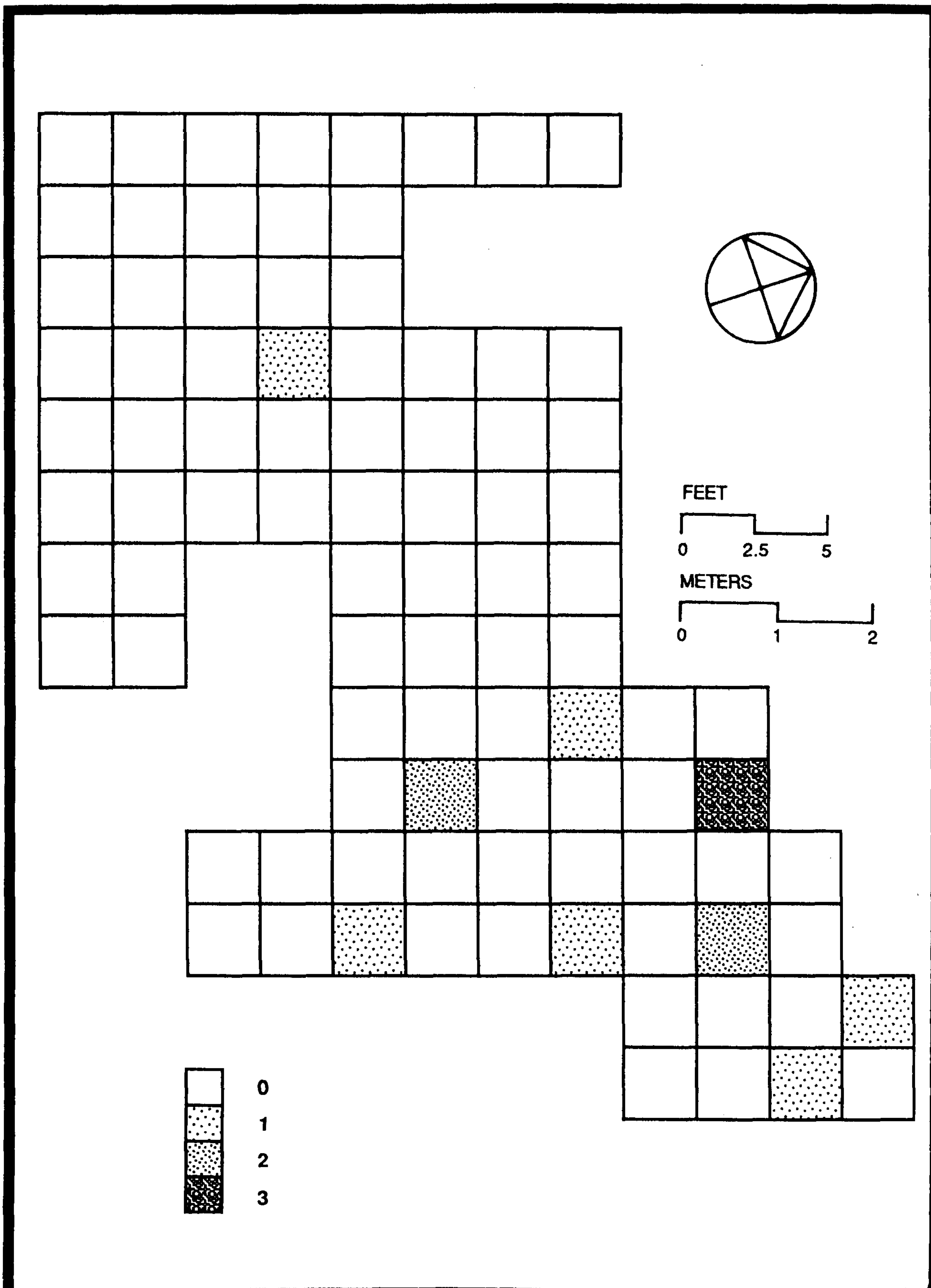


FIGURE 101: Distribution of Chert Debitage, Excavation Block 4 Subsoil

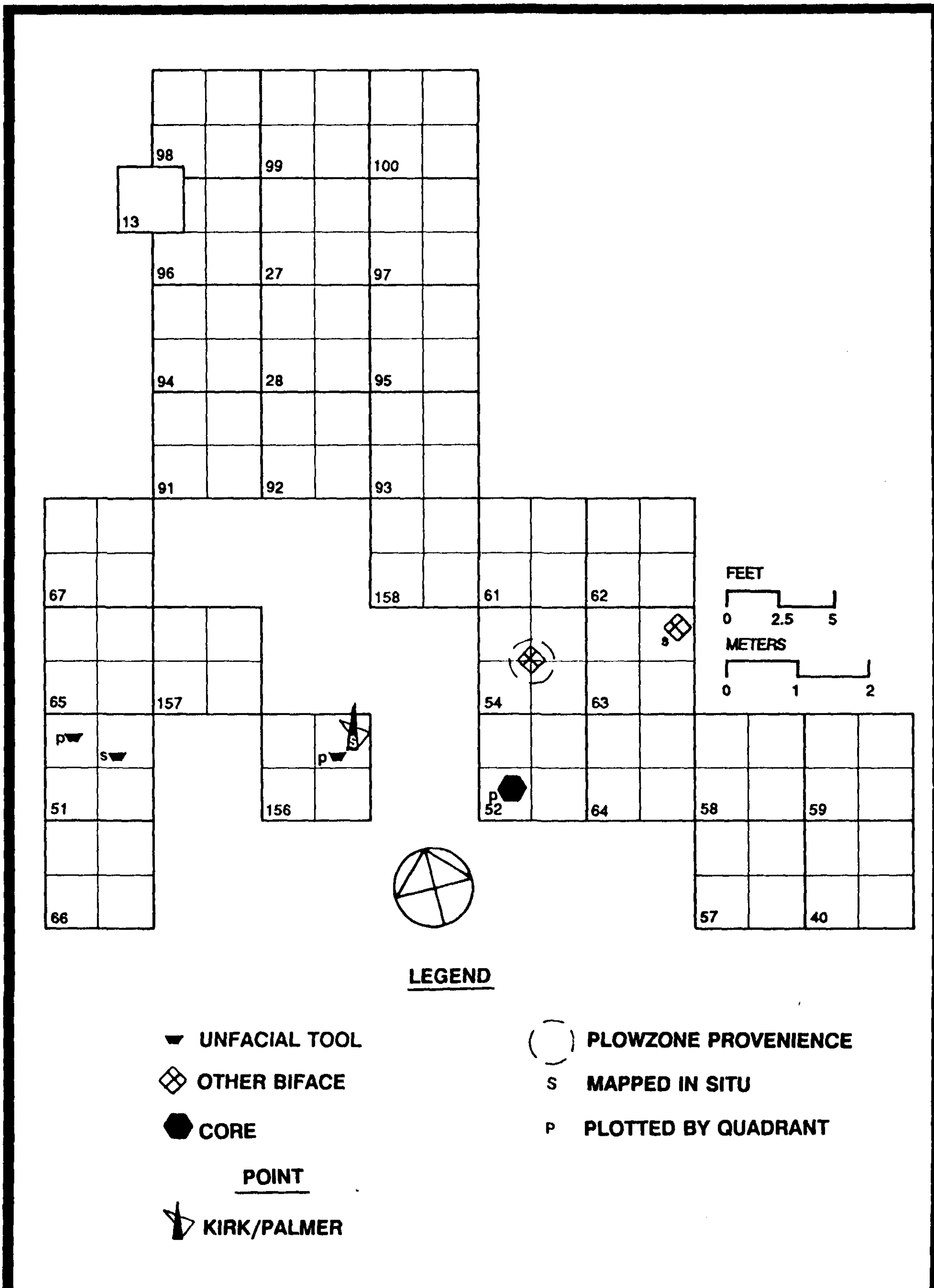


FIGURE 102: Distribution of Chert Tools, Excavation Block 5

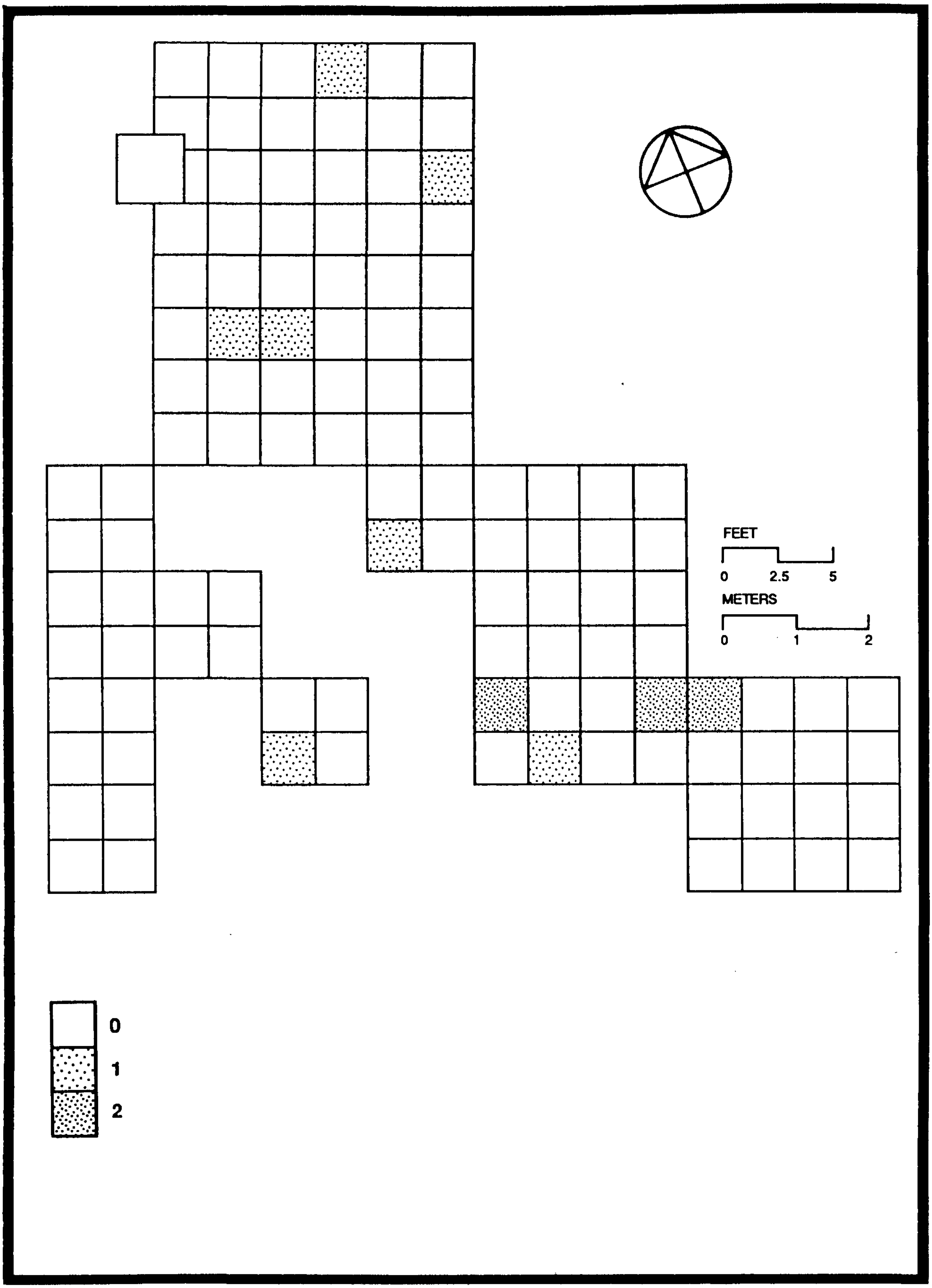


FIGURE 103: Distribution of Chert Debitage, Excavation Block 5 Subsoil

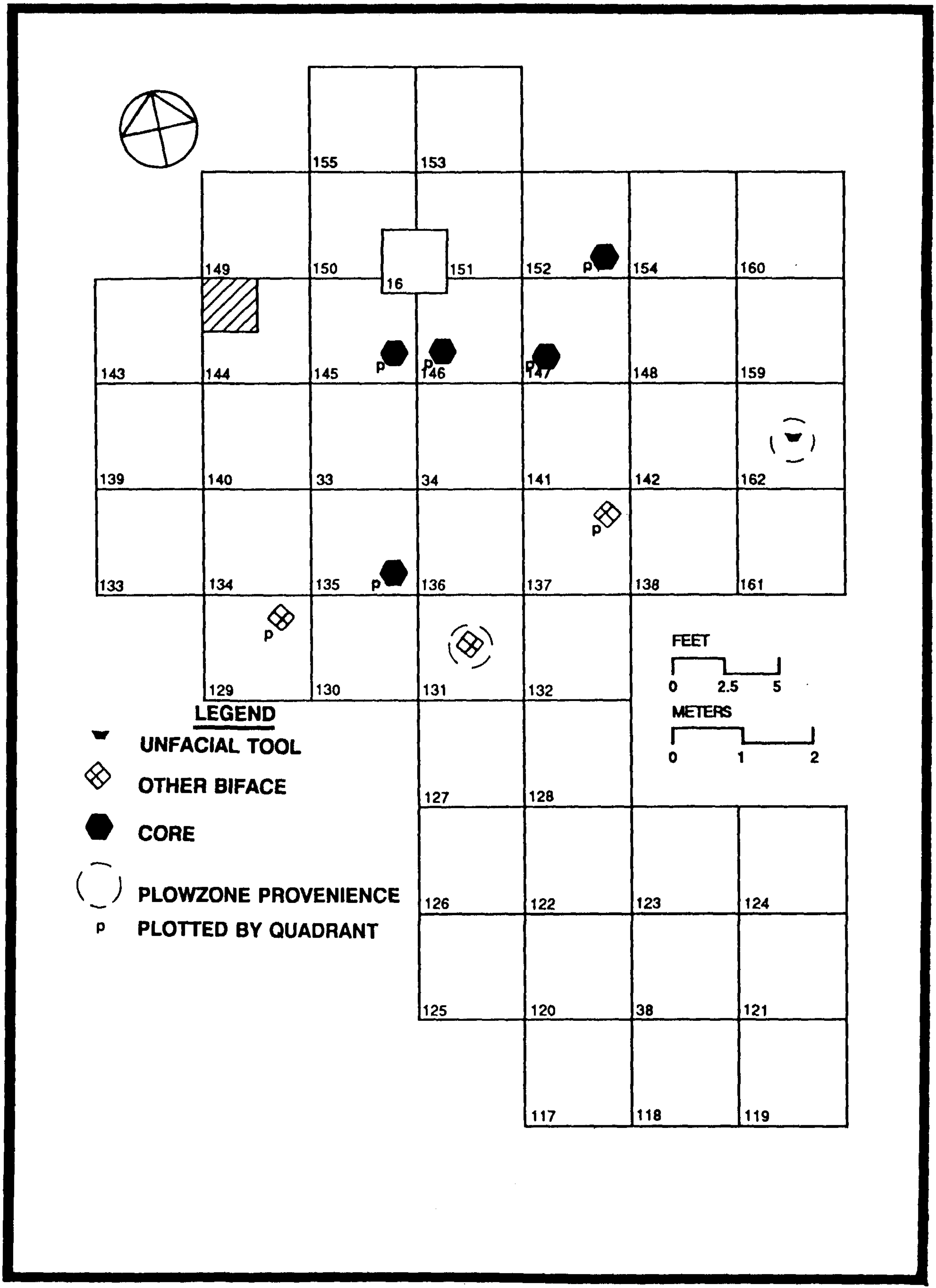


FIGURE 104: Distribution of Chert Tools, Excavation Block 6

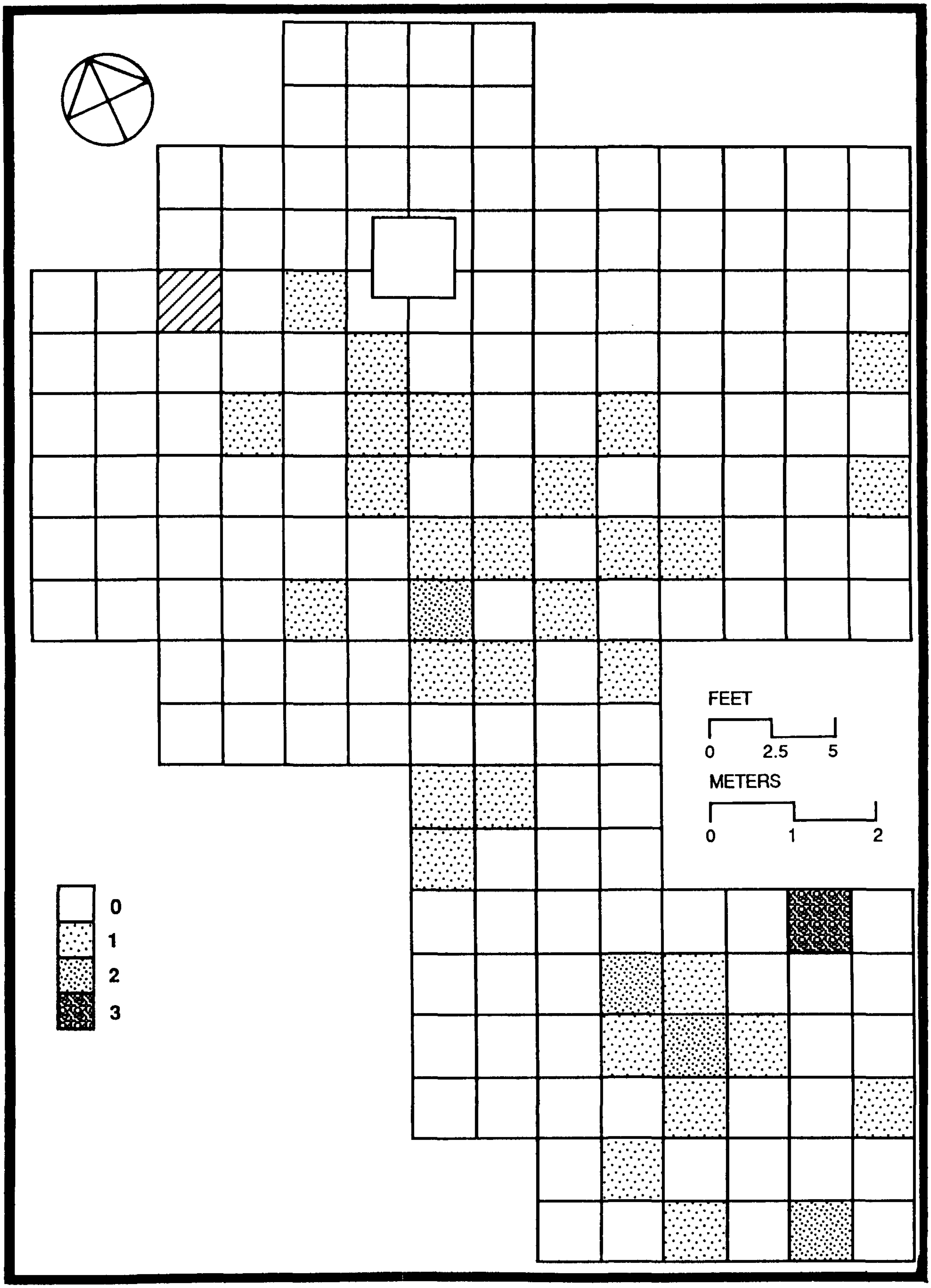


FIGURE 105: Distribution of Chert Debitage, Excavation Block 6 Subsoil

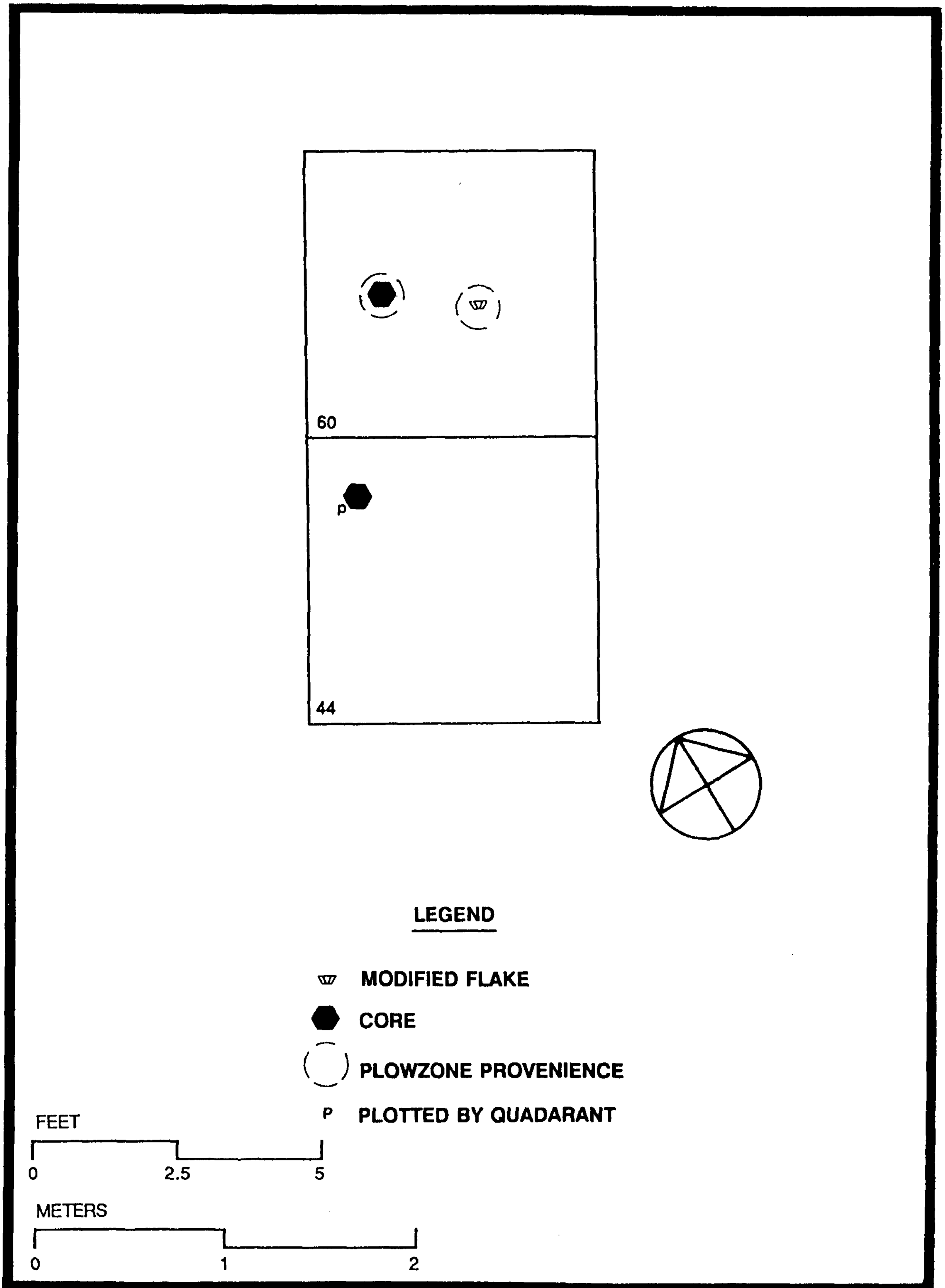


FIGURE 106: Distribution of Chert Tools, Excavation Block 7

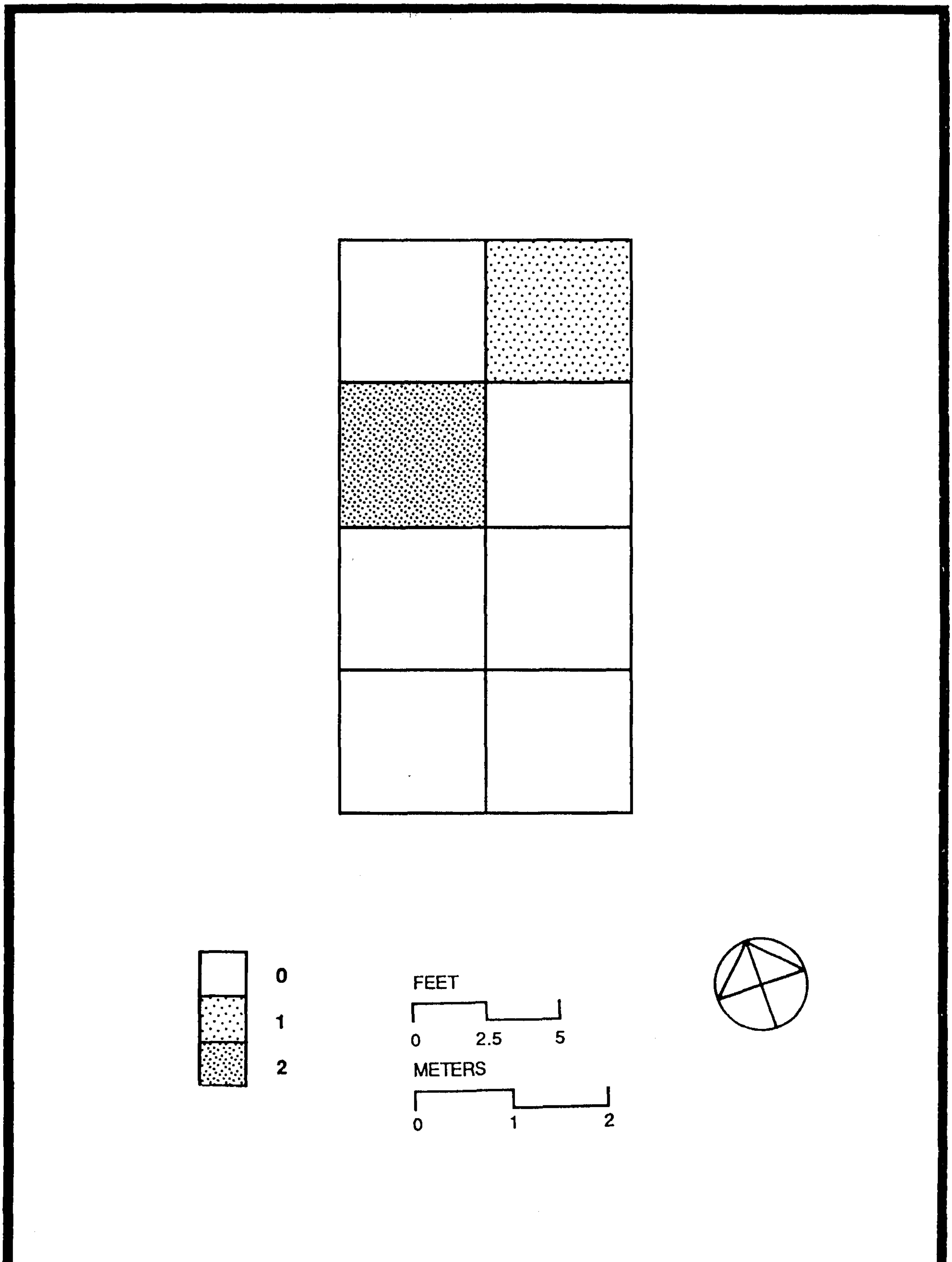


FIGURE 107: Distribution of Chert Debitage, Excavation Block 7 Subsoil

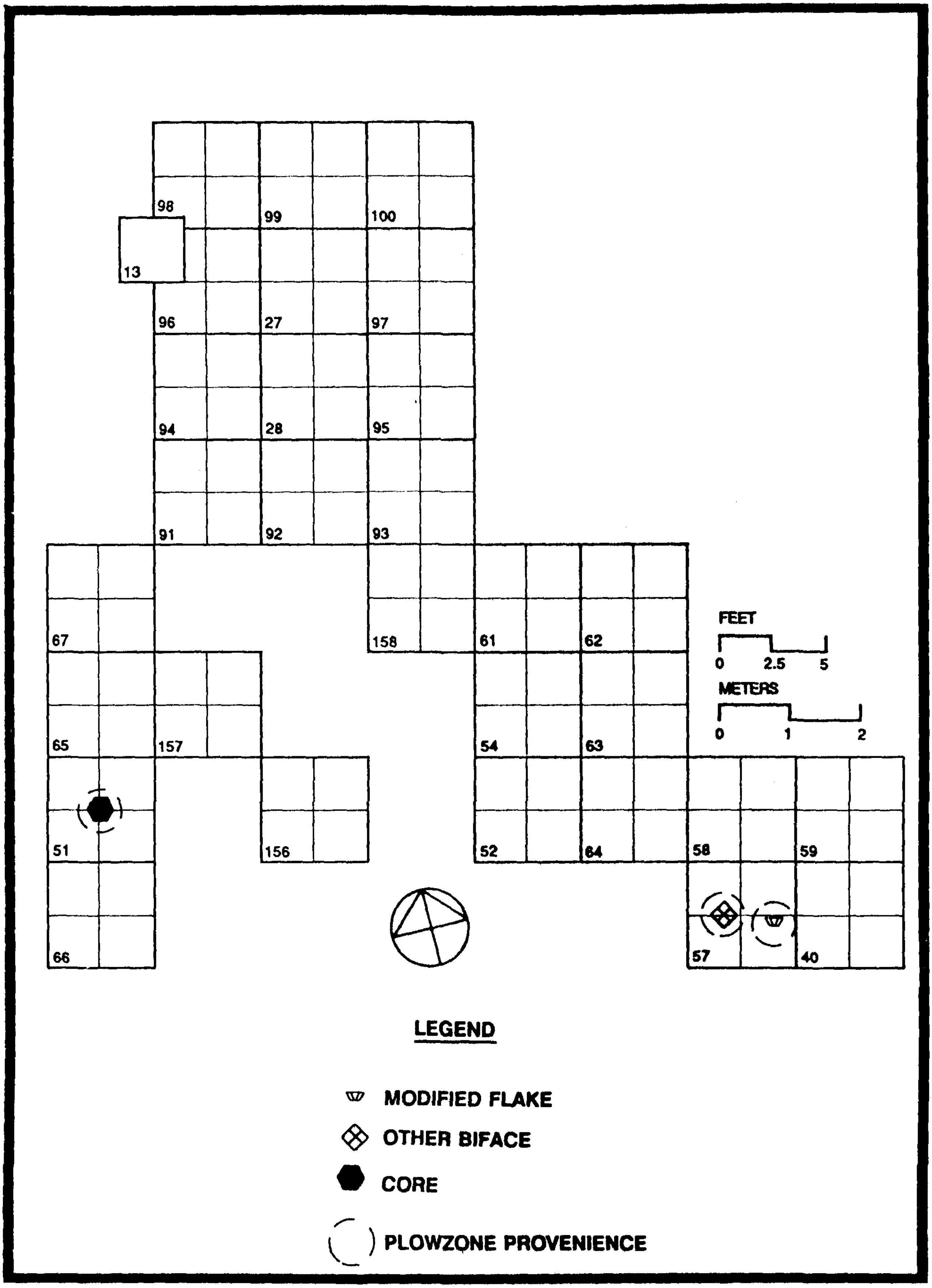


FIGURE 108: Distribution of Chalcedony Tools, Excavation Block 5

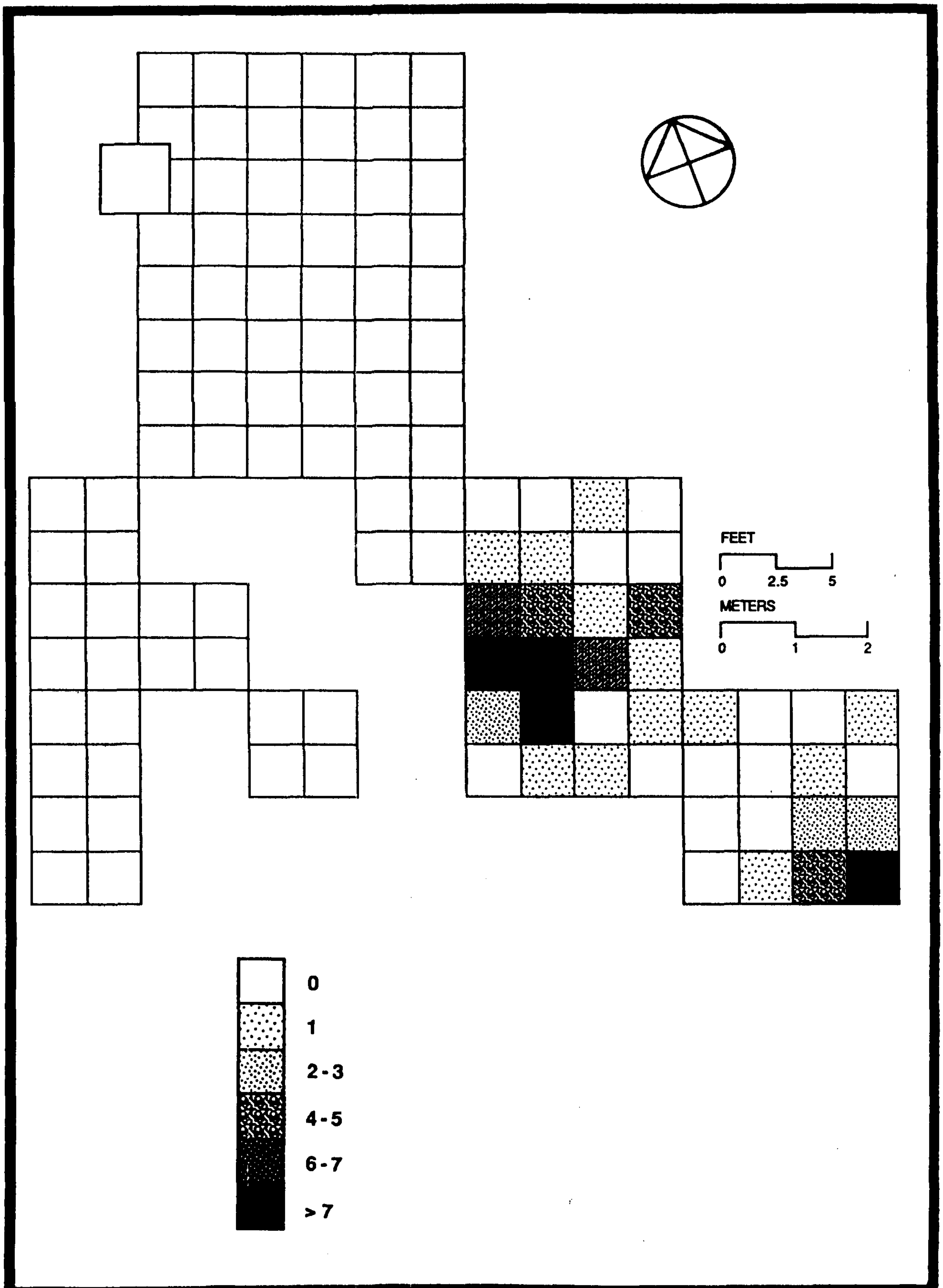


FIGURE 109: Distribution of Chalcedony Debitage, Excavation Block 5 Subsoil

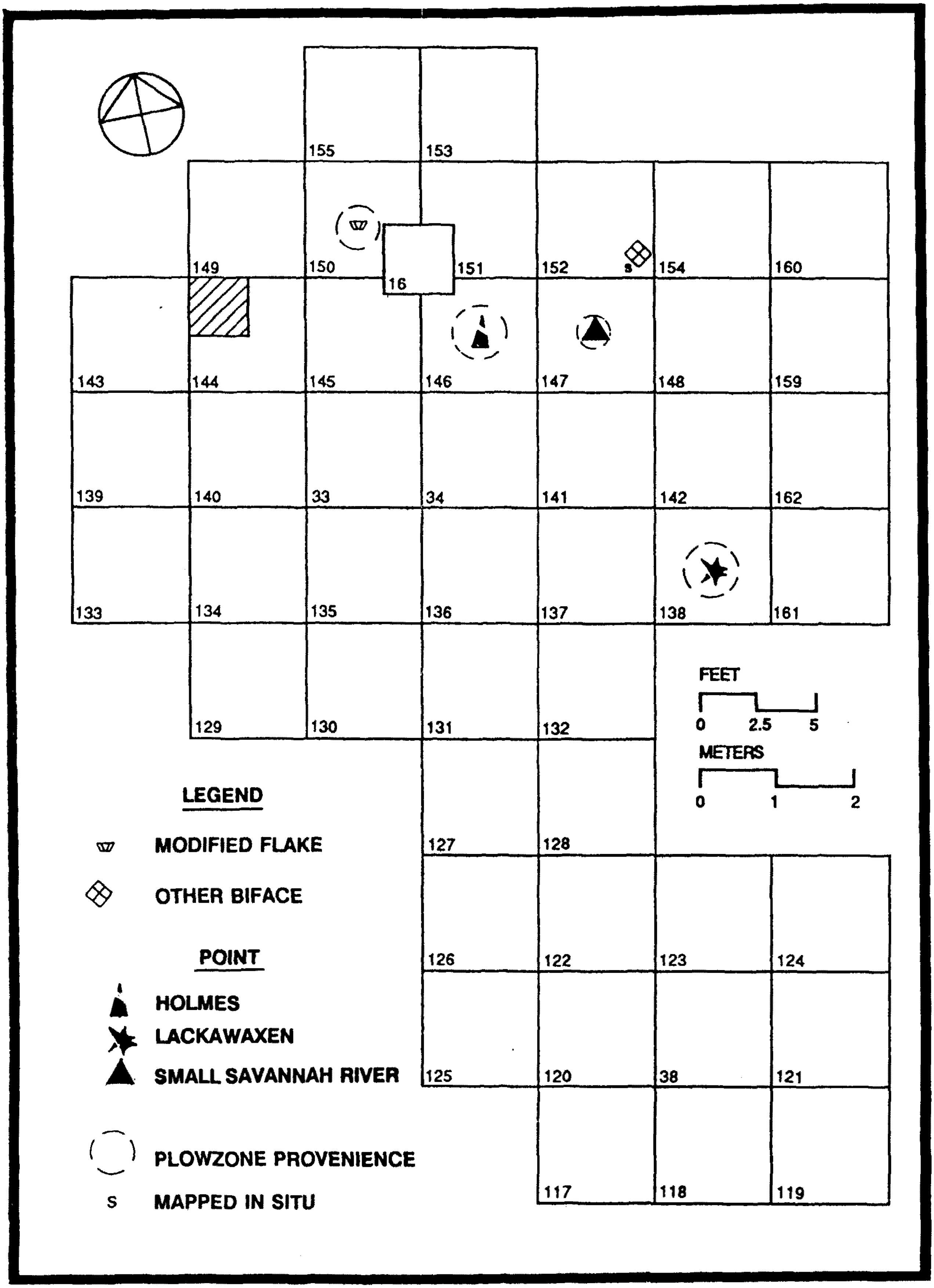


FIGURE 110: Distribution of Chalcedony Tools, Excavation Block 6

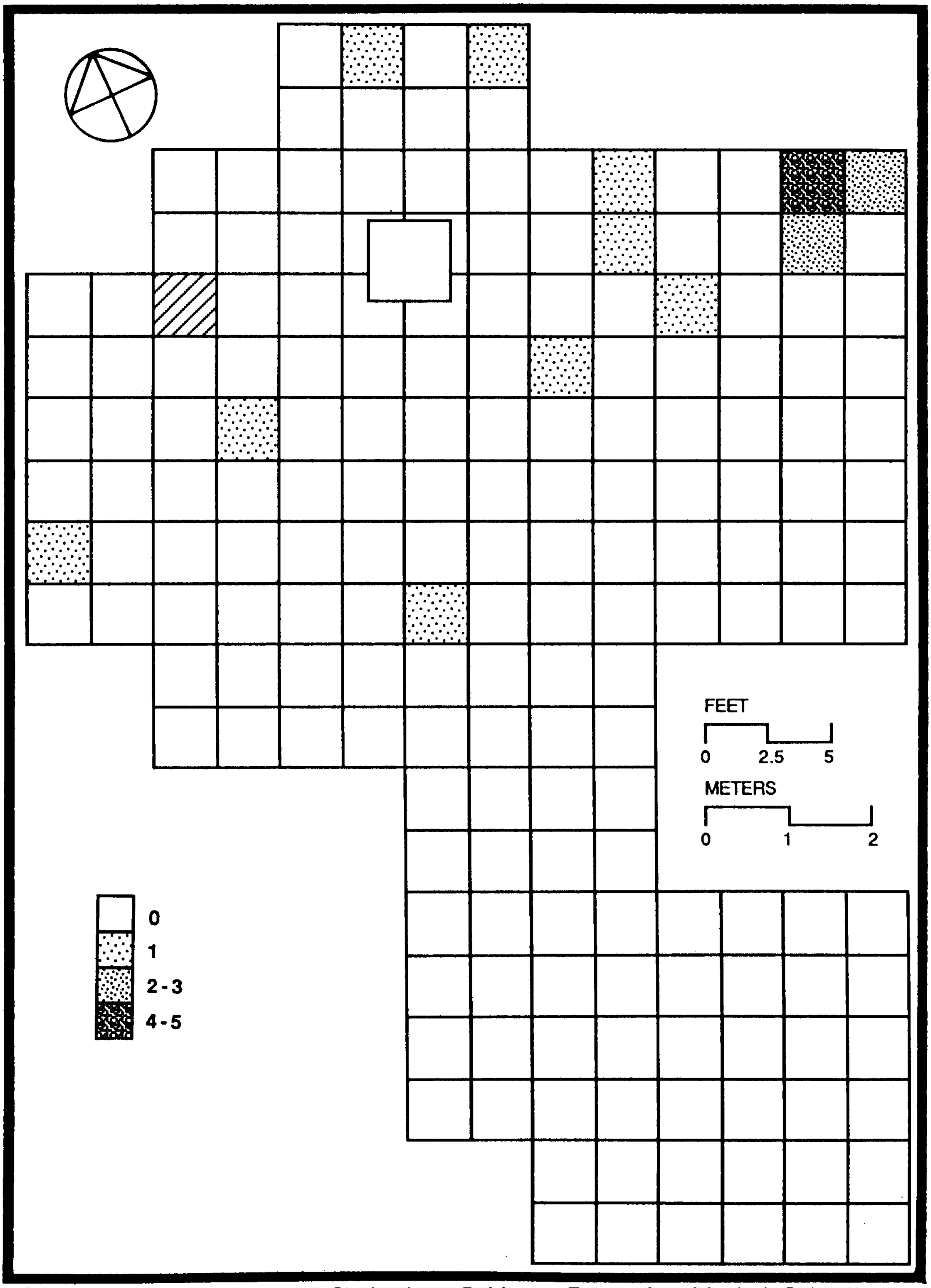


FIGURE 111: Distribution of Chalcedony Debitage, Excavation Block 6 Subsoil

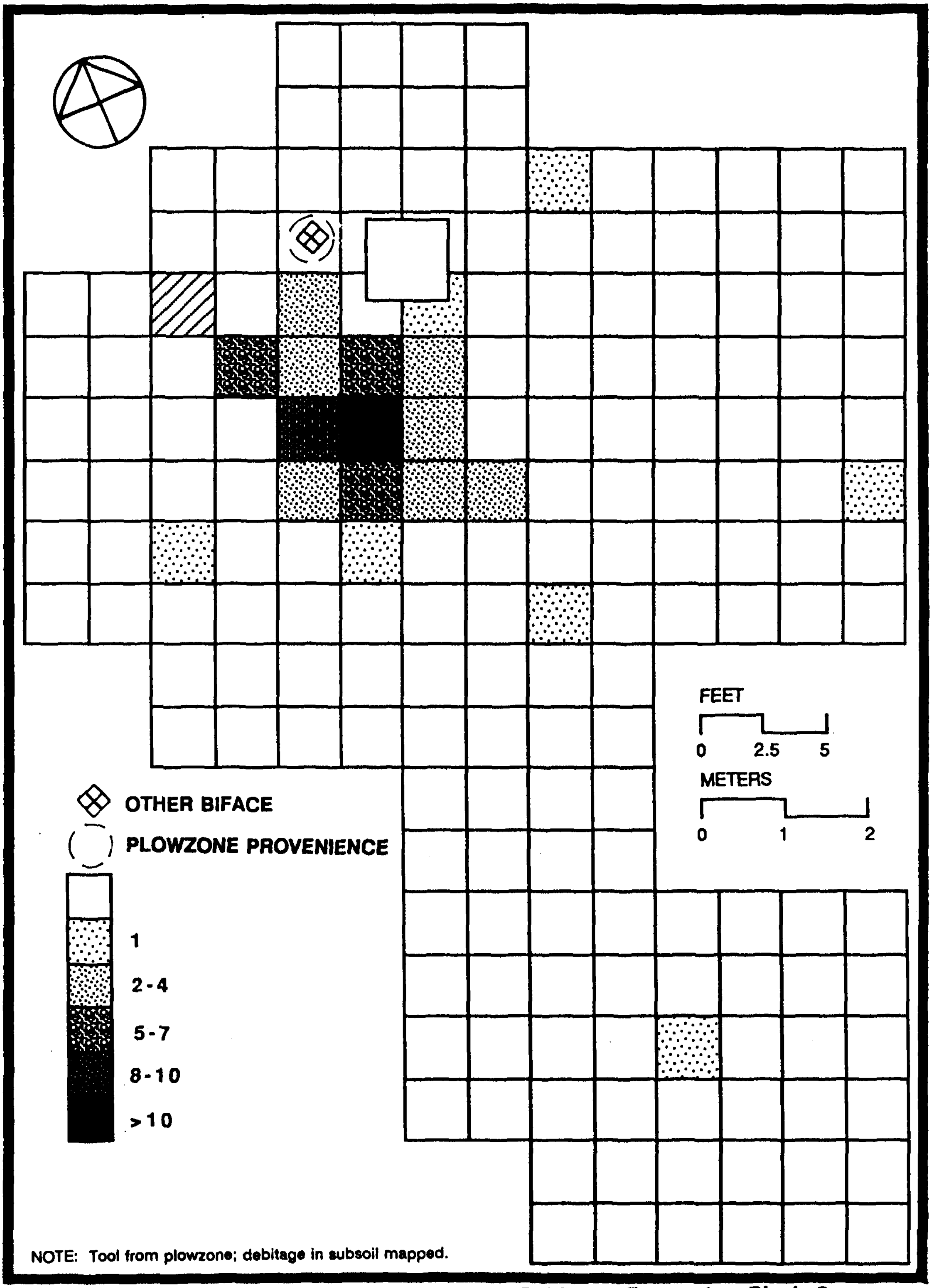


FIGURE 112: Distribution of Jasper Tools and Debitage, Excavation Block 6

IX. FLORAL AND FAUNAL ANALYSIS

A. INTRODUCTION

There are diverse and complicated interrelationships between food acquisition, storage, consumption, and disposal of food by-products in prehistoric sites. It is likely that long before native populations established seasonal settlements, planted and harvested crops, and domesticated animals, they had accumulated an extensive knowledge of plant and animal usage. Prehistoric populations exploited floral and faunal commodities to meet needs beyond subsistence. Plants were obtained to medicate and intoxicate, to make dyes, cordage, mats, baskets, decorative objects, and to construct shelter. Various mammals, birds, turtles, and the like were captured for fur, grease, feathers, or shells.

Faunal and botanical specimens were examined in order to advance understanding of resource availability, resource selection, and procurement for an Archaic period site exploiting a particularized ecozone such as wetlands. Wetlands are among the most important fish and wildlife habitats. Fishes depend on coastal marshes and associated waters for spawning grounds, and numerous waterfowl use wetlands for feeding, resting, and nesting. Furbearing animals, such as muskrat and otter, make their homes in marshes. Vegetation in forested wetland environments is extremely diverse, with many species intermixed.

This research capitalizes on the unique interplay of plant and animal exploitation with culture and the environment and formulates research questions that integrate floral and faunal data into general and specific research goals for the Indian Creek Site. The primary research goals here are to: (1) delineate prehistorically utilized floral and faunal specimens; (2) examine the ecosystem as reflected by the recovered floral and faunal specimens; (3) attempt to elucidate the dietary strategies as employed by the populations utilizing the site; (4) delineate changes in dietary strategies that may be manifest through time; and (5) interpret the functional utilization of the site area.

B. METHODOLOGY

1. Sampling and Specimen Identification

During excavation, flotation samples were taken from feature contexts and from subsoil levels of other units distributed across the site. The standard procedure for the taking of flotation samples was to remove a two-liter soil sample from the northeast corner of all subsoil levels of selected units, in order to provide a series of continuous column samples. Samples were also taken from within defined feature areas, although it was not possible to obtain a full two-liter sample from all features. Off-site soil samples were also obtained for use as control samples.

More than 200 soil samples collected during the Phase II and Phase III excavations were processed for flotation analysis. The soil samples were air-dried and processed in a specially designed drum that provides a continuous froth of water to dissolve the soil, yielding a light fraction and a heavy fraction. The recovery of cultural and biological material during flotation processing is dependent on the size of the mesh used. A fine-mesh polyester "bridal veil" was used for the heavy fraction, and an even finer meshed silk screen fabric was used for the bags to collect the light fraction.

One hundred charred and 100 non-charred poppy seeds were added to two samples prior to flotation. A poppy seed recovery test was used to test effectiveness and consistency of flotation procedures. Poppy seeds range in size from 0.7 millimeters to 1.4 millimeters and are of an appropriate size for testing the effectiveness of micro-seed recovery. The recovery rate is a measure of seed loss, damage, and inter-sample contamination. No contamination was noted and recovered control seeds were not fragmented. The control-seed recovery rate was 91 percent for a one-liter sample from Phase II and 44 percent for a two-liter sample from Phase III. These macrospores were the most frequently encountered botanical artifact. Fern macrospores are smaller in size than the control poppy, seeds which suggests that recovery of microdata was good and that the flotation process was effective for the recovery of very small seeds.

A total of 445 liters of soil was processed from 231 flotation samples. Samples from 63 units were analyzed, including 17 1-liter samples from Phase II units and 209 2-liter samples from Phase III units. In addition, 5 2-liter control samples obtained from off-site were analyzed. Appendix N provides a catalog listing of the site's floral and faunal assemblage, and Appendix O delineates the location, size and recovery rate of each flotation sample analyzed.

The biological materials were examined with a binocular dissecting microscope. Each sample was systematically scanned, and floral specimens were identified and counted. Each floral specimen was given a count value of one. Nutshell was counted and weighed in grams. Charred wood fragments were so small that weighing and counting were feasible for only a few of the larger recovered specimens. If a substantial amount of a particular specimen type was encountered in a sample, these specimens were counted on a grid under the microscope and a portion of them were placed in a labeled vial. Macrospores, panicum, copperleaf, spikerush, sumac, and carpetweed were handled in this manner.

Material was identified to the species level where possible. Confirmation of species was aided by the use of an extensive type collection of floral material and reference materials (Cox 1985; Fernald 1970; Gunn 1970; Lawrence and Fitzsimons 1985; Martin 1972; Martin and Barkley 1961; Mohlenbrock 1980, 1981; Peterson 1977; Renfrew 1973).

2. Delineation of Prehistoric Specimens

Delineation of prehistoric specimens from historic specimens or natural seed rain was the first focus of analysis. To be given consideration as a potential prehistoric floral specimen, two important criteria had to be met. First and foremost in such an analysis, the botanical history of each plant recovered must be considered. Plants which are not native to America obviously were not available to prehistoric populations. If there was a question as to whether a species or subvariety was indigenous or introduced, the specimens in question were analytically treated as indigenous. For example, there are about 28 species of Bedstraw *(Gallium spp.)* in northeastern North America, at least 6 of which have been introduced from Europe and Asia. Because the identification of the recovered specimens could not be refined any further than to determine that they were of the genus *Gallium*, they were considered native for the purpose of analysis.

One method used to delineate modern environmental material from prehistoric specimens was the comparison of five control samples collected from beyond the bounds of the delineated site area with the samples from within the site area. The assumption was that a culturally impacted environmental area should exhibit a different botanical assemblage than a nonculturally impacted environmental area. Examination of the two data sets suggested that indeed the delineated prehistoric site area contained a botanical assemblage that differed from that of the "off-site" assemblage. These findings are discussed in detail in Section G below.

The second important criterion is that seed specimens must have been modified in a manner that allows preservation of what is really a biodegradable material. Investigators generally consider only charred seed specimens as useful (and legitimate) constituents of a prehistoric archaeological floral assemblage (Minnis 1981:147; Quick 1961:94-99) because, given normal soil conditions, seeds will either fulfill their reproductive function or will decay. The dormancy period for most plants is rarely more than 100 years (Harrington 1972), and therefore in order for a seed to survive in the archaeological record it must short-circuit the reproductive function, i.e., by charring. Although desiccation is another way in which seeds can circumvent decomposition, the environment of the northeastern United States makes the desiccation of seeds a very unlikely occurrence. Given the wetland conditions at the Indian Creek Site, dessication was not even a possibility.

All factors that influence preservation must be considered because archaeological plant remains are neither a large nor representative sample of the diet. At an open site in a temperate environment very little plant material is ever preserved. As discussed above, in order to evade microbial action the material must become charred, a process that requires special circumstances and rarely happens. The specimen must first find its way into a fire and ignite. Then it must be withdrawn from the flames quickly before it turns to ash, or it must be buried so deeply in the coals that it cannot find enough oxygen for complete combustion (Keene 1981:183; Wetterstrom 1978:111-112). Following charring, the specimen must be protected from the elements and disturbance in order to remain intact for succeeding centuries. Finally, it must endure the excavation process and the flotation procedure. Clearly, hard items such as nutshell are favored whereas soft items are not.

Plant parts can be categorized into three types: (1) dense inedible parts such as nutshell or fruit pits that might be discarded in or near a fire; (2) moderatly dense parts like small seeds which might be consumed and would only be burned or buried accidentally; and (3) parts with no density and a high water content, such as tubers and greens, which would be consumed and which are unlikely to carbonize under normal circumstances (Keene 1981:183).

It cannot be assumed that carbonized plant remains accurately reflect the diet of the site occupants, because charring is a fortuitous but nevertheless accidental event. While it may be assumed that the uncharred specimens within the samples are not prehistoric in origin, charring alone does not imply unequivocal prehistoric status to a seed specimen. All charred seeds within a sample are not necessarily of prehistoric origin, as it is not uncommon for modern seeds to become incorporated into prehistoric assemblages. Vertical seed dispersion can occur from plowing, root holes, drying cracks, downwashing, and from earthworms and other burrowing animals (Keepax 1977; Minnis 1981:145; Smith 1985). These processes crosscut cultural depositional processes.

3. Sources of Prehistoric Seeds

There are several sources of prehistoric seeds recovered from archaeological contexts. The most widely considered source of prehistoric seeds is direct utilization of the seeds. Many botanical artifacts are the direct result of the collection, processing, and use/consumption of plant resources. Accidents in processing, burning of debris, and the burning of stored materials are the most common actions which result in the direct evidence of seed use (Minnis 1981:145). Few plant parts will be deliberately burned in a fire because most plant refuse is too wet to burn readily or it may smoke or smell if burned. However, the medicinal utilization of plants whereby the leaves or roots were sprinkled on hot stones or boiled or steeped in water could result in charred seed remains. The lining of cooking pits with large leaves could also result in charred seed remains.

Another potential source of archaeological seeds is the accidental preservation of the prehistoric seed rain that is unrelated to any cultural use of the seeds or plant. Naturally dispersed seeds can blow into hearths or be burned on trash middens. Plants can also become carbonized when vegetation is burned off by man or natural means. Day (1953) has documented that many aboriginal groups in eastern North America manipulated local vegetation by the use of fire. Intentional burning of forest cover and second growth to clear land for agricultural or hunting purposes was done to clear campsites, increase visibility, facilitate movement, eliminate rodents, enhance soil productivity, and promote the growth of certain plants.

The amount of plant food used by a prehistoric population may be poorly represented in the archaeological record (Keene 1981). Because of the vagaries of survival for plants brought to open sites, quantitative summaries should be viewed with this in mind.

C. FLORAL ANALYSIS

Floral specimens include seeds, nutshell fragments, macrospores, and small charred wood fragments. A total of 10,037 seeds, macrospores, nutshell fragments, and charred wood fragments were recovered from the test units within the site. An additional 46 floral specimens were recovered from the five off-site control samples. Table 23 lists the recovered botanical specimens, excluding material from the off-site samples.

Sixty-three different plant species were recovered from the test units under study. Table 24 summarizes the general characteristics of each recovered specimen type and indicates whether or not it is considered poisonous, medicinal, edible, a flower, or a tree, and if it is a plant native to America.

This analysis is in keeping with the theoretical perspective that only charred native seeds can be considered a legitimate constituent of a prehistoric floral assemblage. The assemblage contained 3,298 specimens which were not in the charred state. Twenty-five of the 63 recovered species were not represented by any charred specimens. An additional 16 species were recovered both in the charred and uncharred state. Approximately 32 percent of the floral assemblage was uncharred, and approximately half of the uncharred specimens are non-native species. A total of 2 percent of the uncharred specimens are from native species but were recovered exclusively in the charred state. The remaining 15 percent of the uncharred specimens were recovered from native species represented by both charred and uncharred specimens.

1. Non-Native Species

Fifteen percent of the total assemblage was comprised of non-native specimens, including eight seed types. An additional five seed types were identified to genus level but have both native and introduced species. Two of the five seed types with uncertain native status were not represented by charred specimens and were thereby eliminated from intensive analysis. Although it could not be determined if the thistle, clover, and bedstraw were native species, they were represented by charred specimens and are discussed in the "potentially utilized" category (Section C.3 below).

a. Carpetweed

Carpetweed *(Mollugo verticillata)* is an annual weed with a deep taproot which became naturalized throughout North America from tropical America (Cox 1985; Fernald 1970). It is not an early spring plant; germination usually occurs later in the season when conditions are more like those of its warmer native habitat. Its late start is compensated for by a very rapid rate of growth in summer and fall, when it becomes a nuisance in cultivated areas. It is a common weed in a variety of environmental settings. Although the plant can be cooked and eaten as a potherb, it was not available to native populations. A total of 1,432 uncharred Carpetweed seeds were recovered from the site area. This combination of being uncharred and not native provided a fairly straightforward elimination of this plant type from potential prehistoric utilization.

b. Purslane

It is widely believed that Purslane *(Portulaca oleracea)* became naturalized after its introduction to this continent from Europe (Fernald 1970; Knap 1979; Peterson 1977). Botanists generally believe that Purslane, a native plant of India, was adopted as a choice vegetable in Europe and was brought to America with the first settlers. It was apparently adopted by native North Americans,

TABLE 23. SUMMARY OF FLORAL SPECIMENS.

BOTANICAL NAME	COMMON NAME	NO.	WT (gm)	NO CHAR-RED
Acalypha virginica	copperleaf	1,327	.	73
Acinda cannabinus	waterhemp	8	.	8
Amaranthus acinda	waterhemp	2	.	0
Amaranthus spp.	amaranthus	8	.	0
Ambrosia spp.	ragweed	3	.	2
Anthemis cotula	mayweed	8	.	8
Aralia spp.	Hercules' club	1	.	1
Bacopa monniera	waterhyssop	1	.	0
Brasenia schreberi	watershield	99	.	99
Brassica campestris	bird rape	1	.	0
Bromus secalinus	chess	1	.	0
Chamaecrista spp.	partridge pea	1	.	0
charcoal	charcoal	12	3.8	1
charcoal flecks	charcoal flecks	.	0.3	.
Chenopodium spp.	chenopodium	10	.	0
Circium spp.	thistle	3	.	2
Cuscuta gronovii	dodder	2	.	2
Cyperaceae spp.	sedge	1	.	0
Cyperus esculentus	chufa	8	.	7
Cyperus spp.	flatsedge	7	.	1
Digitaria sanguinalis	crabgrass	50	.	5
Eleocharis spp.	spikerush	438	.	436
Eleusine indica	goosegrass	2	.	2
Euphorbia spp.	spurge	24	.	14
Galium spp.	bedstraw	4	.	4
Geranium spp.	geranium	8	.	8
Hedeoma pulegioides	pennyroyal	99	.	99
Hydrocotyle umbrellata	pennywort	2	.	1
Impatiens biflora	jewelweed	2	.	0
Liquidambar styracilua	sweetgum	82	.	3
Lonicera spp.	honeysuckle	1	.	0
Mollugo verticillata	carpetweed	1,430	.	0
Myriophyllum spp.	water-milfoil	15	.	8
nutshell fragment	nutshell frag	1	0.6	1
Nymphaea spp.	waterlily	2	.	1
Oenothera spp.	evening primrose	1	.	0
Oxalis stricta	wood sorrel	3	.	2
Panicum spp.	panicum	133	.	0
Physalis spp.	ground cherry	1	.	1
Phytolacca americana	pokeweed	2	.	0
Picea engelmannii	spruce	7	.	0
Pinus spp.	pine	2	.	0
Polygonatum commutatum	solomon's seal	15	.	9
Polygonella spp.	jointweed	64	.	0
Polygonum punctatum	smartweed	2	.	2
Polygonum spp.	smartweed	55	.	1
Pontederia cordata	pickerelweed	1	.	1

TABLE 23--Continued.

BOTANICAL NAME	COMMON NAME	NO.	WT (gm)	NO CHAR-RED
Portulaca oleracea	purslane	22	.	0
Potamogeton spp.	pondweed	3	.	0
Prunus pensylvanica	pin cherry	1	.	0
Prunus virginiana	choke cherry	1	.	1
PTERIDOPHYTA	fern	5,447	.	5,447
Quercus spp.	oak acorn	3	.	0
Ranunculus spp.	buttercup	1	.	0
Rhus spp.	sumac	359	.	359
Rubus spp.	blackberry	8	.	3
Scirpus spp.	bulrush	62	.	41
Scleria spp.	scleria	6	.	6
Silene spp.	catchfly	23	.	23
Sisyrinchium graminoides	blue-eyed grass	7	.	7
Smilax spp.	greenbriar	1	.	0
Solidago spp.	goldenrod	1	.	0
Sparganium spp.	burreed	28	.	20
Stellaria media	chickweed	5	.	0
Toxicodendron radicans	poison ivy	11	.	11
Trifolium spp.	clover	81	.	4
unident. nutshell	unident. nutshell	8	2.2	8
unident. oblong seed	unident. oblong seed	1	.	1
unident. root frag.	unident. root frag.	1	0.8	0
Verbascum thapsus	mullein	1	.	0
Zostera marina	eelgrass	7	.	7
TOTAL		10,047	19.1	6,745

TABLE 24. FLORAL SPECIMEN INDEX.

BOTANICAL NAME	COMMON NAME	CHARACTERISTICS					
		POI	MED	EDI	FLR	TRE	NAT
Acalypha virginica	copperleaf	X					X
Acinda cannabinus	waterhemp						X
Amaranthus ssp.	amaranthus		X	X			X
Ambrosia ssp.	ragweed			X			X
Anthemis cotula	mayweed		X				NO
Aralia spp.	Hercules' club			X			X
Bacopa monniera	waterhyssop						X
Brassenia schreberi	watershield			X			X
Brassica campestris	bird rape						NO
Bromus secalinus	chess						NO
Chamaecrista spp.	partridge pea	X	X	X			X
Chenopodium ssp.	chenopodium		X	X			X
Cirsium ssp.	thistle		X	X			?
Cuscuta gronovii	dodder		X				X
Cyperaceae spp.	sedge			X			X
Cyperus esculentus	chufa			X			X
Cyperus spp.	flatsedge			X			X
Digitaria sanguinalis	crabgrass						NO
Eleocharis ssp.	spikerush						X
Eleusine indica	goosegrass						NO
Euphorbiaceae spp.	spurge	X	X				X
Gallium ssp.	bedstraw		X	X			?
Geranium carolinianum	geranium		X	X	X		X
Hedeoma pulegioides	pennyroyal		X	X			X
Hydrocotyle umbrellata	pennywort		X				X
Impatiens biflora	jewelweed		X	X			X
Liquidambar styraciflua	sweetgum		X			X	X
Lonicera spp.	honeysuckle			X			X
Mollugo verticillata	carpetweed			X			NO
Myriophyllum ssp.	water-milfoil						X
Nymphaea spp.	water lily			X	X		X
Oenothera spp.	evening primrose			X			X
Oxalis spp.	wood sorrel	X	X	X			X
Panicum ssp.	panicum						X
Physalis spp.	ground cherry	X	X	X			X
Phytolacca americana	pokeweed	X	X	X			X
Picea engelmannii	spruce		X			X	X
Pinus spp.	pine		X			X	X
Polygonatum commutatum	Solomon's seal		X	X			X
Polygonella spp.	jointweed						X
Polygonum punctatum	knotweed/ smartweed	X	X	X			X
Pontederia cordata	pickerelweed			X			X
Portulaca oleracea	purslane		X	X			?
Potamogeton spp.	pondweed			X			NO
Prunus pennsylvanica	pin cherry		X	X		X	X
Prunus virginiana	choke cherry	X	X	X		X	X

TABLE 24--Continued.

BOTANICAL NAME	COMMON NAME	CHARACTERISTICS					
		POI	MED	EDI	FLR	TRE	NAT
PTERIDOPHYTA	fern		X	X			X
Quercus spp.	oak			X		X	X
Ranunculus spp.	buttercup	X			X		?
Rhus ssp.	sumac		X	X			X
Rhus trilobata	skunkbush	?					
Rubus spp.	blackberry		X	X			X
Scripus ssp.	bulrush			X			X
Scleria spp.	scleria/ nutrush			X			X
Silene spp.	catchfly	X	X				X
Sisyrinchium montanum	blue-eyed grass		X				X
Smilax spp.	greenbriar		X	X			X
Solidago spp.	goldenrod		X				X
Sparganium eurycarpum	burreed			X			X
Stellaria media	chickweed		X	X			NO
Toxicodendron radicans	poison ivy	X	X				X
Trifolium spp.	clover		X	X			?
Verbascum thapsus	mullein			X			X
Zostera marina	eelgrass						X

POI: poisonous; MED: medicinal; EDI: edible; FLR: flower; TRE: tree: NAT: native to U.S.

who used the ground seeds as a breadstuff and meal. However, it is interesting to note that *Portulaca* is mentioned in an Icelandic medical manuscript of 1475 as a medicinal plant. Yarnell (1964) reported finding Portulaca archaeologically in North America from 3000-2500 BC and considers that it spread to North America by Indian use. Erichsen-Brown states that despite "all of this evidence the leading eastern American taxonomic botanists today still refuse to recognize Portulaca as an indigenous plant" (Erichsen-Brown 1979:viii). The 22 recovered Purslane specimens were not in the charred state, and, based on that factor rather than its botanical history, it will not be considered prehistoric in origin.

c. Goosegrass

Goosegrass *(Eleusine indica)* is an annual introduced from Asia. It has become a weed of gardens, lawns, vacant lots, and other waste places. Goosegrass thrives in packed ground such as in paths and poor lawns (Martin 1972:19). Two charred seeds were recovered.

d. Chess

Chess *(Bromus secalinus)* is an annual grass which has become naturalized from Europe (Fernald 1970:102). Chess is found over much of the United States. One uncharred seed was recovered.

e. Mayweed

Mayweed *(Anthemis cotula)* is an ill-scented weed that has become naturalized from Europe. Although it is now widespread, it was not a part of the prehistoric American landscape. It should be noted that there is reference to the medicinal use of Mayweed by the Mohegan of Connecticut during the historic period (Tantaquidgeon 1977:70). A total of 8 charred Mayweed seeds were identified within the assemblage.

f. Crabgrass

Crabgrass *(Digitaria sanguinalis)* is a European native weed that was accidentally introduced into America by the colonists. Crabgrass belongs to a genus of about 60 species. Small crabgrass and large crabgrass are vigorous weeds throughout the nation. Both are annuals inadvertently introduced from Europe and both thrive in gardens, fields, ditch banks, and roadsides. They sprout in late spring or early summer and continue growing and flowering until killed by frost in the fall, creating brown or bare patches in lawns. The seeds of both are eaten by birds and the plants are palatable for grazing and for hay. It acquired the name Cropgrass because it develops in fields after harvest (Martin 1972:22-23). A total of 50 seeds were recovered, of which 5 were in the charred state.

g. Pondweed

Pondweed *(Potamogeton spp.)* is a perennial with a slender underwater rhizome, introduced from Europe (Fernald 1970:71). The flower clusters extend above the surface of the water. This plant can become an aggressive weed in polluted water. It was introduced into the Northeast before 1814 and has become widespread. The tubers can be eaten raw or cooked as potatoes (Cox 1985:327). All 3 recovered specimens were uncharred.

h. Chickweed

Chickweed *(Stellaria media)* was introduced from Europe and is now a common plant in North America. Presumably, Chickweed gets its name from the fact that domestic chicks as well as doves, quail, and sparrows favor it as a dietary item. Seeds maintain their viability after passing through the digestive tract; therefore birds and mammals that eat the plant serve as agents of dispersal. It is likely that while importing desired plants, the colonists also imported some weeds. In fact, a traveler in 1740 reported that old English garden weeds such as Motherwort, Groundsel, Chickweed, and Wild Mustard had clung to the Englishman whereever he trod (Earle 1974). Five uncharred seeds were recovered from the units under study.

i. Bird Rape

Bird Rape *(Brassica campestris)* was naturalized from Eurasia (Fernald 1970:708). Bird Rape is a member of the mustard family, which is a weed that thrives in a variety of environmental settings. One uncharred seed was recovered.

j. Buttercup

Buttercup *(Ranunculus spp.)* is a perennial with thick fibrous roots whose flowers produce large quantities of pollen, and each petal has a minute nectar scale at its base. It is self-incompatible and cross-pollinated by insects, but up to one percent of its seeds are produced without fertilization. The seeds and leaves are eaten in small quantities by species of birds and mammals which probably contributes to seed dispersal. The acrid juice of the plant contains a substance that causes blistering of the mouth and intestinal tract if the plant is eaten by humans or livestock (Cox 1985:252-253). There are about 250 species, all from cold or temperate regions. They occur in varied habitats but prefer moist soil of ditch banks, shore margins, and freshwater marshes (Martin 1972:57). Many of the more commonly recognized buttercups are introduced species but several are native (Cox 1985:252; Martin 1972:57). It could not be determined whether the single recovered specimen was native or introduced, but as the seed was uncharred, it from any consideration of prehistoric utilization.

k. Thistle

Thistle *(Cirsium spp.)* may have been introduced from Europe. Only 1 of the 12 species of thistle in North America is native. Two charred specimens were recovered from the assemblage, but they could not be identified to species, and therefore their status is uncertain. Because of this uncertainty, it is noted as possibly not native but will also be discussed as potentially utilized (Section C.3 below).

l. Clover

Some clovers *(Trifolium spp.)* are native to America but the sweet clovers, and others grown for agricultural purposes have origins in Europe and Asia (Richardson 1981:97). Of the 81 recovered seeds, 4 were charred. The clovers could not be identified to the species level, therefore they will be considered as potentially utilized.

m. Bedstraw

There are about 28 species of Bedstraw *(Gallium spp.)* in northeastern North America, at least 6 of which have been introduced from Europe and Asia. As with Thistle and Clover, Bedstraw will also be discussed as potentially utilized.

2. Uncharred Native Specimens

A total of 2 percent of the uncharred specimens are from native species but are exclusively in the charred state. The uncharred specimens are considered modern in origin and representative of the present-day environmental conditions. Amaranthus (8), Chenopodium (10), Chickweed (5), Evening Primrose (1), Goldenrod (1), Greenbriar (1), Honeysuckle (1), Jewelweed (2), Jointweed (64), Mullein (1), Oak acorn (3), Waterhyssop (1), Panicum (133), Partridge Pea (1), Pin Cherry (1), Pine (2), Pokeweed (2), Sedge (1), and Spruce (7), were recovered exclusively in the uncharred state. Blackberry, Bulrush, Burreed, Chufa, Clover, Copperleaf, Wood Sorrel, Pennywort, Ragweed, Solomon's Seal, Sweetgum, Thistle, Waterhemp, Water Lily and Water-milfoil seeds were recovered in the non-charred state. However, these specimen types were also recovered in the charred state and will be discussed under that category. Uncharred specimens are listed in the floral/faunal specimen catalog (Appendix N), and in Tables 23 and 24 but are excluded from further analysis and discussion.

The exclusively uncharred specimens of the assemblage are discussed below.

a) <u>Chenopodium</u>

Chenopodium is a diverse, world-wide genus of which some 20 species occur in the eastern United States and Canada (Hatch 1980:206). Opportunistic weeds such as Chenopodium, Knotweed, and Amaranthus were potentially important plant food for Late Archaic populations (Asch and Asch 1977; Asch et al. 1972; Baker 1980; Ford 1977, 1985; Wilson 1976; Winters 1969). In the spring, weedy genera are available for greens and in the late autumn they are prolific seed bearers. Indians harvested Chenopod seeds by pulling up the entire plant and placing it in a sack. After the plant dried, the seeds fell to the bottom of the sack and were then parched for storage and later crushed in a mortar. The meal was added to breads or cooked in a porridge (Wetterstrom 1978:110). Chenopodium *(Chenopodium spp.)* has been recovered in archaeological contexts in eastern North America in situations suggesting utilization and perhaps even cultivation. None of the 10 recovered Chenopodium specimens were charred.

b. <u>Goldenrod</u>

Goldenrod *(Solidago spp.)* is a perennial which flowers between July and October. Although goldenrod is commonly thought of as an allergy-inducing plant, it is not actually an important cause of hayfever symptoms. Goldenrods are in flower at the time ragweed pollen is at a peak and they are often mistakenly credited as the causative agents in pollen allergies (Cox 1985:172-173). There are ethnographic references for the utilization of goldenrod as a medicinal (Erichsen-Brown 1979:389). One uncharred seed was recovered.

c. <u>Greenbriar</u>

Greenbriar *(Smilax spp.)* is a thorny stemmed vine which climbs by tendrils. It grows in thickets in the Northeast. The large tuberous roots were ground into meal by the Native Americans and used for bread or gruel (Medsger 1966:198). The rootstocks yield a gelatinous substance which can be used as a thickening agent. The young shoots are eaten like asparagus (Peterson 1977:196). The young shoots can be picked well into the summer and the rootstocks are available all year. One uncharred seed was recovered.

d. <u>Honeysuckle</u>

Honeysuckle *(Lonicera spp.)* is a fragrant native shrub. Some species of honeysuckle have edible berries. One uncharred seed was recovered.

e. <u>Jewelweed</u>

Jewelweed *(Impatiens biflora)* is an annual with a dense cluster of fibrous roots. Of the two native species of this genus in the Northeast, *Impatiens biflora* is the most common. Jewelweed is partial to margins of shady swamps and wet woods. Both the young stemsand the seeds are edible. The seeds have a taste of butternuts. The water from cooking the plant or the fresh juice is said to prevent poison ivy rash if applied immediately after exposure. Ethnographic accounts describe the use of the fresh plant to ease the itching caused by poison ivy rash and insect bites (Cox 1985:295). Two uncharred seeds were recovered.

f. Jointweed

Jointweed *(Polygonella spp.)* is a native perennial bushy branched shrub. Jointweed is generally associated with pine barrens. A total of 64 uncharred specimens were recovered.

g. Oak

Three uncharred Oak *(Quercus spp.)* acorn fragments were recovered. Oaks represent one of the most important hardwood segments of eastern forests. Acorns are an important wildlife food. They are the primary overwintering food source for most forest game species (Keene 1981:55).

h. Partridge Pea

Partridge Pea *(Chamaecrista spp.)* is an annual which is more commonly found in dry rather than moist soils. The seeds are quite popular with birds and it is possible that the single recovered seed was deposited by a bird and is not from an indigenous plant. The young shoots are edible and the seeds and leaves of some species are used to treat ringworm, eczema, and other skin diseases (Cox 1985:190-191). One uncharred seed was recovered.

i. Pin Cherry

Pin cherry *(Prunus pensylvanica)* is a shrub or small tree found in the northeastern part of the United States. The bright red cherries are too sour to eat raw but are edible if cooked. Birds are especially fond of them and soon strip the trees (Medsger 1966:50). One uncharred pit was recovered.

j. Pine

Pines *(Pinus spp.)* are probably the world's most abundant conifers. About 100 species are recognized worldwide, and 36 of these species are native to the United States (Neelands 1968:10). Two uncharred pine specimens were recovered.

k. Sedge

Sedge *(Cyperaceae spp.)* is a grasslike or rush-like herb with fibrous roots. Sedge is a large, widely dispersed family. One uncharred seed was recovered.

l. Spruce

Spruce *(Picea engelmannii)* trees grow best in moist soils. They are widely distributed in coniferous forests (Neelands 1968:24). Seven uncharred seeds were recovered.

m. Pokeweed

Pokeweed *(Phytolacca americana)* is a native perennial whose young shoots can be cooked as greens. The root, the mature plant, and the seeds are poisonous. The Pamunky Indians of Virginia used a tea made by boiling the berries (Cox 1985:242). The Mohegan of Connecticut mashed the berries to make a poultice. They also used the juice from the berries to make a dark blue stain (Tantaquidgeon 1977:75). Pokeweed is a common weed found in pastures, fields, and waste places. Two uncharred seeds were recovered.

n. Panic Grass

Panicum *(Panicum spp.)* belongs to a large genus of about 160 species in North America. Panicum, or as it is sometimes called, panic grass, is quite abundant on the East Coast. It is considered a weed and there is no indication that it is edible for humans. Two species are grown in the tropics to provide hay and forage for animals (Martin 1972:24). A total of 133 uncharred seeds were identified.

o. Pigweed

Amaranthus *(Amaranthus spp.)* has been recovered in archaeological contexts in eastern North America in situations suggesting utilization and perhaps even cultivation. Gilmore (1931) examined quantities of dry-preserved material from rockshelters in southwestern Missouri and northwestern Arkansas and identified corn, squash, and seeds of sunflower, chenopods, marsh elder, canary grass, giant ragweed, and amaranth, all in situations suggesting they had been stored.

Despite this finding, the use of *Amaranthus* (Pigweed) by aboriginal peoples is still not fully understood. Peterson and Munson (1984:317-337) present a comprehensive explanation and summary of the problems surrounding the inclusion of Pigweed as a prehistorically utilized food. There are numerous questions associated with the identification, productivity, availability, and usage of Pigweed. There are some 60 species of *Amaranthus* and it is difficult to distinguish them utilizing only the seed. Pollen analysis is of no great help because it cannot differentiate Amaranth pollen to the species level. Further, it is not possible to distinguish the family *Amaranthaceae* from *Chenopodiaceae* (except with an electron microscope). There is debate as to whether all species are native to America (Tucker and Sauer 1958:259-60). There is also debate as to the economic attractiveness of Pigweed to aboriginal gatherers/cultivators. No charred specimens were recovered from the site area.

p. Mullein

Mullein *(Verbascum thapsus)* is a biannual producing a low rosette of leaves in the first year and a stout stalk topped by a clublike flowerhead in the second. It is found in moist waste places. It flowers in May and September. The leaves can be dried and used to make a tea (Peterson 1977:72). One uncharred seed was recovered.

q. Waterhyssop

Waterhyssop *(Bacopa monniera)* is found on the edges of streams, ditches, or riverbanks. It is a dense, low-lying plant which forms mats (Cox 1985). No references could be located referring to any utilization of this plant by either humans or wildlife. One uncharred seed was identified.

r. Evening Primrose

Evening Primrose *(Oenothera spp.)* is a biennial which normally develops a pinkish rosette of leaves and a fleshy taproot in the first-year of growth. The seeds have been demonstrated to have a great longevity, showing germinability after storage for 70 years in the soil (Cox 1985:238). This is a very large native genus. The first year roots, collected in late fall or early spring can be cooked as a root vegetable (Cox 1985:238). One uncharred seed was recovered.

3. Potentially Utilized Charred Specimens

Only specimens that are both charred and of native origin are eligible for consideration of prehistoric utilization. As discussed earlier, meeting these two criteria certainly does not guarantee prehistoric utilization. A large proportion of the charred specimens (99.8 percent) are of potential economic utility either as food, smoking material, or medicine.

Table 25 lists only the totals of the charred native specimens recovered from the site area. Table 26 shows the distribution of plant food by the categories of nuts, tubers/rootstock, shoots/leaves, starchy seeds, and fruits. A total of 99.8 percent of the charred native specimens have tubers, greens, rootstock or starchy seeds suitable for use. The following is a description of each recovered plant type with potential utility to prehistoric populations.

a. Burreed (Tuber--Food)

Burreed *(Sparganium eurycarpum)* is a native perennial with a shallow horizontal tuber-bearing rhizome and fibrous roots. Burreed is found on the edges of streams, muddy shores, wet soil, and inland marshes and is common in the Northeast. These plants do not form extensive mats as do some aquatics, but they do produce local colonies that are good cover for marsh birds and waterfowl. The leaves and stems provide a source of food that is favored by deer and muskrats. This is an important wildlife food as the seeds are eaten by several species of ducks. The creeping rootstocks produce small tubers in the fall that can be eaten like a potato. The tubers are usually widely scattered and are somewhat difficult to gather in quantity (Cox 1985:356-357; Peterson 1977:230). A total of 20 Burreed seeds were recovered.

b. Bulrush (Tuber, Starchy Seeds-Food)

Bulrush *(Scirpus spp.)* is a tall plant generally found in dense stands in shallow fresh or brackish water. The young shoots as well as the tender cores at the bases of older shoots are good eaten raw or cooked. The pollen and ground-up seeds can be used as flour and the tips of the rootstocks are rich in starch and sugar and roasted several hours, can be eaten like potatoes. The rootstocks can also be dried and pounded into flour. The shoots are available in the spring, the pollen in the summer, the seeds in the fall, and the rootstock in the fall and early spring (Peterson 1977:230). A total of 41 charred seeds were recovered. Two uncharred seeds were also recovered.

c. Chufa/Scleria/Flatsedge (Tuber--Food)

Chufa *(Cyperus esculentus)* is a grasslike tuber belonging to the sedge family. The culms or stems grow from one to three feet tall (Medsger 1966:171). It is found in damp sandy soil. Slender, scaly runners terminated by small nutlike tubers radiate from the base of the plant. The tubers, which are edible, are sweet and have a nutty flavor. The tubers can be eaten raw, cooked, or ground into a flour (Peterson 1977:230). The most important aspect of assessing the Chufa in a prehistoric diet is that it was available all year long. Seven charred specimens were recovered.

Flatsedge *(Cyperus spp.)* is a low to medium-height, erect, grasslike herbaceous plant which grows 8 to 40 inches tall (Tiner 1987:177). Its habitat is inland marshes, swamps, and wet shores (Tiner 1987:177). Flatsedge is similar to Chufa in that it has a tuberous rhizome. It is likely that it was utilized in the same manner as Chufa. One seed specimen was recovered.

Scleria *(Scleria spp.)* is also in the Sedge family. Scleria, or nutrush, as it is sometimes called, shares many characteristics of habitat and potential usage with Flatsedge and Chufa (Tiner 1987). There is more documentation that Chufa was utilized by historic native populations than there is for the usage of Scleria and Flatsedge. One of the most important characteristics of these plants is that the tuberous rhizome would have been available all year long to prehistoric users. Because of the similarity of these plants, they will all be considered as potentially utilized. Six seeds were recovered from the site area.

TABLE 25. SUMMARY OF CHARRED NATIVE BOTANICAL SPECIMENS.

BOTANICAL NAME	COMMON NAME	NO.	WT (gm)	NO CHAR-RED
Acalypha virginica	copperleaf	135	0	73
Acinda cannabinus	waterhemp	8	0	8
Ambrosia spp.	ragweed	2	0	2
Aralia spp.	Hercules' club	1	0	1
Brasenia schreberi	watershield	99	0	99
charcoal	charcoal	1	0.5	1
Circium spp.	thistle	2	0	2
Cuscuta gronovii	dodder	2	0	2
Cyperus esculentus	chufa	7	0	7
Cyperus spp.	flatsedge	1	0	1
Digitaria sanguinalis	crabgrass	5	0	5
Eleocharis spp.	spikerush	436	0	436
Euphorbia spp.	spurge	14	0	14
Galium spp.	bedstraw	4	0	4
Geranium spp.	geranium	8	0	8
Hedeoma pulegioides	pennyroyal	99	0	99
Hydrocotyle umbrellata	pennywort	1	0	1
Liquidambar styracilua	sweetgum	3	0	3
Myriophyllum spp.	water-milfoil	8	0	8
nutshell fragment	nutshell frag.	1	0.6	1
Nymphaea spp.	water lily	1	0	1
Oxalis stricta	wood sorrel	2	0	2
Physalis spp.	ground cherry	1	0	1
Polygonatum commutatum	Solomon's seal	11	0	9
Polygonum spp.	smartweed	4	0	3
Pontederia cordata	pickerelweed	1	0	1
Prunus virginiana	choke cherry	1	0	1
PTERIDOPHYTA	fern	5,447	0	5,447
Rhus spp.	sumac	359	0	359
Rubus spp.	blackberry	3	0	3
Scirpus spp.	bulrush	43	0	41
Scleria spp.	scleria	6	0	6
Silene spp.	catchfly	23	0	23
Sisyrinchium graminoides	blue-eyed grass	7	0	7
Sparganium spp.	burreed	20	0	20
Toxicodendron radicans	poison ivy	11	0	11
Trifolium spp.	clover	8	0	4
unident. nutshell	unident. nutshell	8	2.2	8
unident. oblong seed	unident. oblong seed	1	0	1
Zostera marina	eelgrass	7	0	7
TOTAL		6,801	3.3	6730

TABLE 26. SEASONAL AVAILABILITY OF PLANT FOOD.

PLANT PART	MONTHS OF AVAILABILTY												HABITAT
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Starchy Seeds													
Ragweed									X	X	X		disturbed ground
Bulrush								X	X				shallow water
Water lily									X	X			quiet water
Pickerelweed						X	X	X	X	X	X		moist soil, marshes
Knotweed/Smartweed								X	X	X	X		disturbed ground
Blue-Eyed Grass*					X	X	X						sandy wet soil
Tubers													
Fern				X	X	X							moist woods
Bulrush			X	X					X	X			shallow water
Chufa	X	X	X	X	X	X	X	X	X	X	X	X	damp sandy soil
Scleria/Nutrush	X	X	X	X	X	X	X	X	X	X	X	X	damp sandy soil
Flatsedge	X	X	X	X	X	X	X	X	X	X	X	X	damp sandy soil
Burreed				X	X				X	X	X		shallow water
Watershield			X	X	X				X	X	X		quiet water
Water lily				X	X				X	X			quiet water
Root													
Thistle			X	X	X				X	X	X		disturbed ground
Sumac	X	X	X	X	X	X	X	X	X	X	X	X	inland wetlands, various habitats
Solomon's seal	X	X	X	X	X	X	X	X	X	X	X	X	woods, thickets
Sweetgum	X	X	X	X	X	X	X	X	X	X	X	X	wet mixed woodlands
Fern				X	X	X							moist woods
Hercules' Club	X	X	X	X	X	X	X	X	X	X	X	X	moist woods
Geranium				X	X	X							moist woods
Hercules' Club	X	X	X	X	X	X	X	X	X	X	X	X	moist woods
Catchfly	X	X	X	X	X	X	X	X	X	X	X	X	moist woods
Copperleaf	X	X	X	X	X	X	X	X	X	X	X	X	disturbed ground
Poison Ivy	X	X	X	X	X	X	X	X	X	X	X	X	moist woods
Spikerush							X	X	X	X			damp thickets
Ground Cherry	X	X	X	X	X	X	X	X	X	X	X	X	thickets, woods
Shoots/Leaves													
Knotweed/Smartweed				X	X	X	X	X	X	X			disturbed ground
Thistle				X	X	X	X	X	X	X			disturbed ground
Blackberry			X	X	X								woods, thickets
Solomon's seal		X	X	X									woods, thickets
Pennyroyal	X	X	X	X	X	X	X	X	X	X	X	X	moist woods
Sumac			X	X	X	X	X	X	X	X	X	X	disturbed ground
Chenopodium						X	X	X	X	X			disturbed ground
Amaranthus				X	X	X	X	X	X	X			disturbed ground
Ferns				X	X	X							stream/riverbanks, woods
Blackberry	X	X	X	X	X	X	X	X	X	X	X	X	thickets, edge of woods
Hercules' Club					X	X	X						damp woods
Bedstraw						X	X	X					disturbed ground
Spurge				X	X	X	X	X	X				disturbed ground
Ferns				X	X	X							stream/riverbanks, woods
Bulrush			X	X									shallow water
Watershield			X	X	X								quiet water
Thistle				X	X	X	X	X	X	X			disturbed ground
Pickerelweed				X	X	X							moist soil, marshes
Sweetgum				X	X	X	X	X	X				wet mixed woodland
Ground Ccherry					X	X	X	X	X	X			thickets, woods
Clover					X	X	X						variety of settings
Wood Sorrel					X	X	X	X					moist woods
Catchfly				X	X	X	X						moist woods
Dodder						X	X	X	X	X	X		moist soil
Poison Ivy			X	X	X	X	X	X	X	X			moist woods
Pennywort						X	X	X	X				moist thickets
Water-milfoil							X	X	X				quiet water
Fruits													
Blackberry						X	X	X	X				woods, thickets
Sumac						X	X	X	X	X			inland wetlands, various habitats
Hercules' Club							X	X	X				moist woods
Ground Cherry							X	X					thickets
Choke Cherry							X	X					thickets

*uncertain which part of plant was used.

d. Watershield (Tubers, Leaves--Food and Medicine)

Watershield *(Brasenia schreberi)* is a perennial aquatic with a long horizontal rhizome shallowly buried in bottom mud. Watershield is important in some areas as a source of food for ducks. They eat the seeds and probably contribute to the dispersal of the plant. It also provides good shade and shelter for fish. Watershield is found in sluggish streams. The very young leaves can be used in salads or cooked as greens. The small tuberous roots were used for food by Native American groups (Cox 1985:331). The tubers can be eaten like a potato. The tubers can be gathered in quantity by freeing them from the mud with a stick and collecting them as they float to the water's surface. Although somewhat unpleasant tasting when eaten raw, they are delicious when cooked. They can also be ground into flour (Peterson 1977:96). The leaves are available in the spring and the tubers are available in the fall and early spring. A total of 99 seeds were recovered.

An early writer discussing medical flora wrote the following about watershield:

> The underside of the leaf is covered with a coat of pale jelly, sometimes purplish, . . . the leaves afford one of the few instances of pure homogenous vegetable jelly, being spontaneously produced, and covering the whole under surface of the leaves and the stem. Deer are very fond of eating these leaves; even swim in the water in search of them. They are mucilaginous, astringent, . . . tonic and nutritious. When dry the gelatinous matter almost disappears yet they impart mucilage to water . . . unnoticed as yet by all medical writers but well known to the Indians (Rafinesque [1828] as quoted in Erichsen-Brown 1979:211).

e. Water Lily (Tubers, Leaves, Flowerbuds, Starchy Seeds-Food and Medicine)

Water Lily *(Nymphaea spp.)* has large platterlike leaves which float on the water's surface. The young unrolling leaves and unopened flowerbuds are a source of greens. The seeds are rich in starch, oil, and protein. Removed from their spindle-shaped pods, the large seeds can be fried like popcorn, or parched and the winnowed kernels ground into flour, or creamed like corn. The rootstock produces brown tuber the size of hens' eggs; these can be freed from the mud using the feet and collected as they float to the surface. The large rootstock can be used like potatoes. The seeds are available in the late summer and fall and the rootstock is available in the fall and early spring (Peterson 1977:22).

Smith wrote of the Potawatomi:

> According to Pokagon, the root of the sweet scented water lily was used as a poulticing material when it was pounded, but our informant did not tell us what ailments it was supposed to cure. The forest Potawatomi gather large quantities of the root . . . giving it the name of pine snake, because of the appearance of the roots when the water has dried away exposing them. The roots were cut in quarters to dry better. The root is pounded into a pulp, either fresh or dried to use as a poulticing material for many inflammatory diseases (Smith 1933, Ethnobotany of the Potawatomi, Bulletin Museum Milwaukee 7:32-127, as quoted in Erichsen-Brown 1979:209).

Numerous ethnographic accounts of the Iroquois, Chippewa, Menomini, and Ojibwa describe medicinal utilization of the Water Lily as an astringent for poultices (Erichsen-Brown 1979:209-211). One seed specimen was identified in the site area.

f. Thistle (Leaves, Stems-Food)

It could not be ascertained whether the Thistle recovered within the sample was a native or introduced species. It is discussed as a potentially utilized plant but this factor should be borne in mind. Thistle *(Cirsium spp.)* is a biennial with prickly leaves. With the spines removed, the young leaves can be eaten raw or cooked as greens. The pithy young stems are excellent peeled and eaten raw or cooked. The raw or cooked roots of the first year plants are good. Young leaves, young stems and roots would be available at their best in the spring and fall (Peterson 1977:126). Thistles are adaptable and found in numerous environmental settings. There are references to thistle being eaten by historic Native American populations. In fact, *Cirsium edule* is referred to as Indian Thistle (Medsger 1966:200). Two specimens were recovered from the site area.

g. Fern (Leaves, Tuberous Rootstock--Food, Medicinal, Lining for Storage and Fire Pits)

The largest component of the assemblage were macrospores from the fern family. A total of 5,447 charred macrospores were recovered from the units under study. PTERIDOPHYTA are plants without true flowers which reproduce chiefly by spores. Some classes of vascular cryptogams produce male microspores and larger female macrospores. Large spores can reach several millimeters in diameter. All macrospore specimens were charred.

One of the first green edible plants in spring is the newly emerging curled frond of ferns. In early spring the new fronds could be gathered and eaten raw, cooked, or simmered in soups and stews for their thickening qualities (Kavasch 1979:68). Ferns are high in oil and starch and the slender stalks could be ground into flour for bread. The rhizome (underground stem) could be baked like potatoes in hot coals and then worked with other substances into cakes or gruels. In Virginia, Native Americans used hickory ashes as seasonings for this vegetable (Kavasch 1979:72).

Members of the fern family have also been documented as utilized by American Indians for medicinal purposes (Harris 1985:95). The Cherokee placed great remedial value on several species of ferns as antirheumatics because the unrolling of the fronds suggested the straightening out of contracted muscles and limbs. It was thought that rheumatism was caused by worms, since the cramped movements of the patient resembled those of the worm. The roots were used as a worm expellant (Harris 1985:31). Ferns were also used by East Coast tribes as an absorbent dressing for open sores and wounds (Kavasch 1979:69-70).

Fern constitutes 81 percent of the assemblage and it predominated in each excavation block. Fern macrospores comprise the largest component of the floral assemblage, and it is important to understand why fern is so dominant in the assemblage. One explanation lies in the fact that the undersides of the leaflets contain thousands of spore cases each containing thousands of macrospores (Cobb 1963:36). Therefore millions of spores are produced each season and thereby, by virtue of the sheer volume, have an increased likelihood of being incorporated into the archaeological record. While this is certainly a factor not to be ignored, a more important reason why macrospores are so prevalent is that ferns were used to line cooking pits (Stewart 1982). This functional utilization provides an ideal opportunity for macrospores to become charred and incorporated into the archaeological record.

The high frequency of fern was corroborated by the residue analysis performed on lithic artifacts (see Appendix Q). Fern antiserum was utilized which does not give positive results with other plants or animals. Three artifacts tested positive for fern (Newman 1990). This is a provocative finding and suggests that cutting tools were used to gather stances of ferns. It further supports the argument that charred fern macrospores are cultural manifestations.

h. Geranium (Stem, Root--Medicine)

Geranium *(Geranium spp.)* is a native perennial common to the Northeast. Wild geranium is found in moist woods. The familiar potted geraniums are a member of this family but belong to a different genus introduced from South Africa. Although it is not a major wildlife food, its seeds are eaten by several species of birds and small mammals (Cox 1985:65).

The rhizome of wild geranium has a high tannin content, which has led to its extensive use as an astringent. Wild geranium is commonly called Alum Root. When the rhizome is dried and ground it yields a purplish brown powder which was used for dysentery and diarrhea. Historic American Indians and early settlers used it to treat thrush, a fungal disease of the mouth in children. Some tribes of American Indians sprinkled the powdered rhizome on wounds to stop bleeding (Cox 1985:66). References appear for the use of geranium as a medicinal aid for the Cherokee, Chippewa, Cheyenne, Navaho, Choctaw, Fox, and Iroquois (Moerman 1986:718). A total of 8 specimens were recovered.

A publication in 1846, in discussing ethnographic medicinal practices recounts:

> One of the remedies in great use amongst them is the *Geranium maculatum* which many eminent physicians of the United States rank as one of the most powerful vegetable astringents, being principally composed of tannin and gallic acid. With the Indians it is a favorite external styptic, the dried root being powered and placed on the mouth of the bleeding vessel (Winder 1846:11 as quoted in Erichsen-Brown 1979:278).

i. Pennyroyal (Leaves, Blossoms--Medicine, Insect Repellent)

Pennyroyal *(Hedeoma pulegioides)* is a native American aromatic herb of the mint family. It is found in moist woods and fields and is widespread in the eastern United States. It has many medicinal uses thought to have been developed by American Indians. It was used as an insect repellent by rubbing the fresh leaves upon the skin (Krause 1983:173). An observer writing in the Aborigines of Virginia in 1608 noted that plants of the mint family were often mixed with bear grease and spread upon the body to keep away lice, fleas, and ticks (Erichsen-Brown 1979:449-450; Kavasch 1979:143). According to early accounts, the Indians were generally free of skin diseases and maintained healthy skin by frequently "washing" the skin with the oils of fishes and the fats of eagles, raccoons, or bears and mixing it with certain herbs to lend fragrance and added protection (Kavasch 1979:143).

Pennyroyal was also used as a gentle aromatic stimulant (Harris 1985:128). The leaves and blossoms were steeped and the brew used as a drink to relieve headaches by the Onondagas, the Apaches, and the Mescaleros (Kavasch 1979:152). A total of 99 specimens were recovered.

j. Clover (Leaves, Blossoms--Medicine and Food, Smoking Material)

Some clovers *(Trifolium spp.)* are native to America but the sweet clovers and others grown for agricultural purposes have origins in Europe and Asia (Richardson 1981:97). Ethnographic accounts attest to the popularity of clovers with Native American populations. They cooked the leaves, moist after washing, in layers between hot stones. The clover blossoms were also used medicinally and as a smoking material in pipes (Richardson 1981:98). Clovers would have been available from May to October (Cox 1985:214-215). Four of the 9 recovered seeds were in the charred state.

k. Wood Sorrel (Leaves--Food, Beverage)

Wood sorrel *(Oxalis spp.)* is a perennial with a creeping, scaly, horizontal rhizome. The flowers are visited and possibly pollinated by small bees and flies. This is a fragile light-sensitive species that typically after sunset has closed flowers and drooping, folded leaves. The leaves are similar in appearance to clovers (Cox 1985:94). Wood sorrel clusters in shady moist woods and is quite common to Pennsylvania, Delaware, and Virginia. The leaves are edible although they contain oxalic acid which is toxic in large amounts (Cox 1985:94). The stems and leaves can be eaten raw, boiled in water and used as a beverage, or as an herb to flavor meats. Berglund and Bolsby report that northeastern Native Americans extensively used wood sorrel and were aware of its potential toxic qualities if eaten in large quantities (1971:97). They reported that porcupine was generally cooked with wood sorrel leaves as seasoning (1971:97). Two seeds were identified from the site area.

Captain John Smith reported on Virginia Indians in 1612:

> Many hearbes in the spring time there are commonly dispersed throughout the woods, good for brothes and sallets, as Violets, . . . Sorrell . . . The (Indians) chiefe root they have for food . . . sliced and dried in the sun, mixed with sorrell and meale or such like (as quoted in Erichsen-Brown 1979:333).

Smith reports that the Potawatomi did not use wood sorrell as medicine but rather as a food (Erichsen-Brown 1979:333).

l. Sumac (Leaves, Root--Smoking Material, Dye, Medicine, and Basket Making; Fruit--Beverage)

Sumac *(Rhus spp.)* is a small tree or shrub with dense clusters of small fruit. Poison Sumac is easily distinguished from other varieties of sumac because the poisonous berries are white and all others are red (Medsger 1966:214). When soaked in water, the fruit makes a delicious beverage (Peterson 1977:186). The beverage has been dubbed "Indian lemonade" (Medsger 1966:213). There is extensive documentation for the medicinal utilization of numerous species of Sumac by the Navaho, Ojibwa, Delaware, Chippewa, Fox, Pawnee, Ponca, Iroquois, and Potawatomi. The uses ranged from elimination of worms to healing snakebites and sores (King 1984:74; Vogel 1970:376).

Sumac leaves and root were used to make a ceremonial tobacco mixture and the split stems were used in basket making (Moerman 1986:402-407). According to the Historical Dictionary of 1813 (as quoted in Kavasch 1979:165), Sumac berries became so esteemed in Europe for smoking that they were preferred to the best of the cured Virginia tobacco. It was reported by an early writer in 1779 that:

> An Indian carries pouch and pipe with him wherever he goes, for they are indispensable. For state occasions they may have an otter skin pouch or a beaver-pouch . . . In the pouches they carry tobacco, fire material, knife and pipe. Sumac is generally mixed with tobacco or sumac smoked without tobacco (as quoted in Erichsen-Brown 1979:115).

It is further reported in 1778 that:

> Sumac likewise grows here in great plenty; the leaf of which, gathered . . . when it turns red, is much esteemed by the native. They mix about an equal quantity of it with their tobacco, which causes it to smoke pleasantly (Carver 1778:30 as quoted in Erichsen-Brown 1979:115).

Byrne and Finlayson (1974) report that Staghorn Sumac made up 15.6 percent of the wild plant seeds found at the Crawford Lake Site in Ontario. They were found in 39.3 percent of the features examined--pits, ovens and middens. They were the only seeds identified to the species level (Erichsen-Brown 1979:115). At the Draper Site in Ontario, Sumac seeds archaeologically represented the fourth largest amount of all seeds recovered (Erichsen-Brown 1979:115).

A report written by Harriot in 1590 entitled Virginia Indians says about sumac:

> Dyes of divers kindes. There is Shoemake well knowen, and used in England for blacke . . . The inhabitants use them only for the dyeing of hayre; and colouring of their faces, and Mantles made of Deare skinnes; and also for the dying of Rushes to make artificial workes withal in their Mattes and Baskettes (as quoted in Erichsen-Brown 1979:115).

A total of 359 charred seeds were recovered from the site area.

m. Hercules' Club (Root--Food, Beverage, Medicine and Berries--Medicine)

Hercules' Club *(Aralia spp.)* is a perennial shrub or small tree with a long horizontal aromatic rhizome. This genus of North America is represented by four woodland species in the Northeast. It is one of the most common plants of the northeastern woods (Richardson 1981:57) Hercules' Club is similar to Sarsaparilla, with which it shares characteristics of tastes and utilization. The aromatic rhizomes may be used to make a tea which tastes like root beer. *Aralia* is not related to the true Sarsaparilla *(Smilax officinalis),* which is a native of South America; however, it is reputed to have the same attributes and to have been used in virtually the same manner as the true Sarsaparilla (Richardson 1981:57). Native Americans of the Northeast are said to have used the rhizome of the *Aralia* for food on long marches and hunting trips (Cox 1985:32). A report from the eighteenth century recounts that the roots are aromatic and nutritious and that the Indians would subsist upon them for lengthy periods during war and hunting excursions (Erichsen-Brown 1979:351).

The plant flowers in late spring or early summer and the berries ripen by July. Green at first, they later flush to a purplish-black hue (Richardson 1981:57). All parts of the plant of the *Aralia* genus are said to have an aromatic taste but apparently the root is the portion most commonly used. The berries are not edible because they contain a poisonous glycoside (Richardson 1981:57), but there is ethnographic documentation that berries were crushed and used medicinally for wounds and ulcers (Erichsen-Brown 1979:352).

Ethnographic accounts are numerous in regard to the medicinal properties of *Aralia*.. In herbology, *Aralia* rhizome was powdered and used by Northeast groups to make a cough medicine. *Aralia* was also used by the Cherokee for backache and rheumatoid arthritis (Cox 1985:33). Smith reported that the Potawatomi valued the root and pounded it into a mass to be used as a poultice to reduce swelling and to cure infections (Erichsen-Brown 1979:353). One charred seed was recovered.

n. Spurge (Leaves, Root; Flower--Medicine)

Spurge *(Euphorbia spp.)* is a native perennial (Cox 1985:206). As a food source, the seeds are important to several species of game and song birds. There are about 36 species in North America. Flowering Spurge is found in old fields, pastures, waste areas, along roadsides, and in open woods. In herbology several species are recommended for the initiation of vomiting and as purgatives. However, the milky juice of these plants contains toxic compounds. The sap may cause blistering and inflammation of the skin in sensitive individuals. Death in cattle has been reported from the eating of hay that contained spurges (Cox 1985:206).

There is extensive documentation that the ground leaves and flowers of spurge were used for snake bites by the Navaho, Shoshone, and Pima; as a urinary aid by the Cherokee; a lip balm by the Hopi; and as a worm expellant by the Fox (Moerman 1986:184-187). The roots were used as a cathartic by the Meskwaki and the Ojibwa (King 1984:111). A total of 14 seeds were recovered.

o. Solomon's Seal (Tubers, Leaves-Food and Medicine)

Solomon's Seal *(Polygonatum commutatum)* is an herb found in profusion in shaded woods. It produces edible rootstocks and shoots that are available in the spring and fall. The berries can cause vomiting and diarrhea if eaten by humans (Cox 1985:79). The Iroquois used the thick rootstocks to pound into breads and ate the tender young shoots as spring greens and food extenders (Kavasch 1979:59). While writing about the Iroquois in 1916, Waugh stated that "the roots of . . . Solomon's Seal are referred to as having been used as food in the Iroquois area, but have been practically forgotten by present day Iroquois" (Waugh [1973] as quoted in Erichsen-Brown 1979:341).

There is extensive ethnographic documentation for the medicinal use of Solomon's Seal by the Cherokee, Ojibwa, Iroquois, and Rappahannock (Moerman 1986:356-357). The root was heated on coals, dried, or boiled for relief of coughs and headaches, and as a salve for cuts (Moerman 1986:356-357). Nine of the 11 recovered seeds were in the charred state.

p. Catchfly (Roots, Leaves--Medicine)

Catchfly *(Silene spp.)* is a colorful perennial with weak or prostrate stems. This is a very large genus represented in North America by about 54 species. In the Northeast, 18 species have been recognized, including several that have been introduced from Europe (Cox 1985:51). The genus name is derived from the Greek word for "salvia" and refers to the sticky secretions the plant exudes to trap insects (Richardson 1981:88). It is not an important wildlife food, but the plants are eaten by a few species of birds and small mammals. It is found in moist woods (Cox 1985:51). No portion of the plant is edible by humans; however, there is ethnographic documentation for its medicinal use. The roots and leaves were pounded and used as a poultice for burns, bites, and swellings by the Menominee and Navaho (Moerman 1986:452-453). A total of 23 seeds were recovered from the site area.

q. Copperleaf (Root--Medicine)

Copperleaf *(Acalypha virginica)* is a common weed of pastures, woods, cultivated fields, gardens, and waste places. Copperleaf belongs to the spurge family Euphorbiaceae (Martin 1972:78). Copperleaf seeds are eaten freely by gamebirds and songbirds. Plants grow to a foot or two in height and the leaves turn copper color when mature (Martin 1972). Moerman (1986:4) reports that the Copperleaf root was used by the Cherokee as a urinary aid and miscellaneous disease remedy. A total of 135 seeds were recovered, of which 73 were in the charred state.

r. Ragweed (Starchy Seed--Food)

Ragweed *(Ambrosia spp.)* is noted for its allergy-inducing pollen and has come to be an obnoxious weed. Ragweed often develops solid luxuriant stands in fields after a grain crop has been harvested (Martin 1972:130). Rigorous growths of Ragweed are usually found on fertile soil suitable for cultivated crops.

As early as 1931, Gilmore suggested that Ragweed was cultivated by the prehistoric Ozark bluff dwellers (Gilmore 1931). Subsequent studies (Payne and Jones 1962) cast doubt on the cultigen status of Ragweed. Virtually no evidence of Ragweed cultivation was forthcoming from botanical studies of eastern North America until quite recently (Cowan 1985:214). At the Cloudsplitter rockshelter in eastern Kentucky, Ragweed achenes are entirely absent from the deposits before 3000 BP but begin to appear in Early Woodland deposits. Ragweed is found in clear association with squash, gourd, sunflower, Chenopodium, sumpweed, and maygrass, and although they are usually found in low quantities in comparison to the other annuals, the association is interesting (Cowan 1985). Ragweed-harvesting experiments were conducted and it is reported that the seeds of this plant are the least efficient to harvest of any of the Eastern Complex plants and that only in a dense field-type situation would it be practical (Cowan 1985:215).

While only 2 charred specimens were recovered, this is a provocative finding. The starchy ragweed seeds may have been utilized at this site, which would be the earliest archaeological manifestation in the geographical region.

s. Pickerelweed (Starchy Seed, Leaves-Food)

Pickerelweed *(Pontederia cordata)* is a perennial found growing in dense stands in marshy soil. The fleshy herbaceous plant can attain heights of more than three feet. The nut-like seeds can be eaten raw or roasted and ground into a flour. The seeds are starchy and have a taste that resembles that of potatoes (Richardson (1981:23-24). The young unrolling leaves can be added to salads or cooked as greens (Cox 1985:342-343). The young leaves are available in the spring and the nut-like seeds from late summer into early fall (Richardson (1981:23-24). One charred seed was recovered.

t. Dodder (Stems--Dye and Medicine)

Dodder *(Crusta gronovii)* is a rootless, leafless, twining, parasitic plant. The slender stem is white, yellow, or red , bears no leaves, and in the seedling stage attaches itself by suckers to the stem or leaves of some other plant around which it twines and from which it derives its nourishment. On coming in contact with the living stem of a susceptible plant, the seedling Dodder throws out suckers which penetrate the host, its tissues establishing organic union. By this means water is drawn from the host. The Dodder soon ceases to have any connection with the ground. After making a few turns around one shoot, the dodder finds its way to another, and continues twining and branching until it resembles fine, closely tangled, wet catgut. Some of its colloquial names are Strangle-weed, Hellweed, Love vine, and Devil's Guts.

It is of interest that Dodder is reported to do great damage to flax, clover, hops, alfalfa, peas, and bean crops (Martin 1972). The plants can also spread viral diseases from one host to another. Dodders have been declared noxious weeds in the seed laws of 42 states and by the Federal Seed Act (Cox 1985:304). Preventive or control measures for infestations of Dodder include early cutting of fence rows, ditches, and weed fields to prevent seed production. Mowing infected areas and burning the residue is recommended for clover and alfalfa crops. In some parts of the United States, it has been suspected of causing digestive disorders in horses and cattle (Cox 1985:303).

Dodder was used ethnographically as a dyestuff to give an orange color to feathers. The vines were boiled and the materials to be dyed were dipped. The Pawnee name for Dodder translates as "yellow vine" (Gilmore 1977:58). There is ethnographic evidence that the Cherokee used Dodder in a poultice for bruises (Hamel and Chiltoskey 1975:32). Two charred specimens were identified.

u. Poison Ivy (Leaves, Stems, Roots--Medicine, Warfare Tactic, Poison Arrows, Dye)

Poison Ivy *(Toxicodendron radicans)* is most noted for the white juice that is released from a leaf or stem when it is broken. The juice turns dark on exposure to air and carries in it the poisonous resin toxicodenfrol, which causes the skin to develop allergic symptoms. Burning Poison Ivy or Sumac leaves, twigs or roots releases this resin in the form of tiny droplets on particles of the ash and dust in the smoke from the fire and can cause severe reactions. It is interesting that there are ethnographic reports that Native Americans on the St. Lawrence would gather large piles of Poison Iivy leaves and fruits and set them on fire as they saw the enemy approaching during warfare (Erichsen-Brown 1979:110-112). The thick poisonous smoke would cause the enemy either to turn back or be suffocated. There is also an interesting ethnographic reference to the use of Poison Ivy juice to use on the tip of arrows (Erichsen-Brown 1979:110-112). The Cherokee, Iroquois, Fox, Ponca, and Potawatomi used the pounded root in a poultice for sore, boils, warts, and infections (Moerman 1986:404-405).

There are ethnographic indications that the juice was used as a black dye. It is said to have been used by the Native Americans to stain the hardest substances black (Erichsen-Brown 1979:110-112). A total of 11 charred seeds were recovered.

v. Sweetgum (Sap, Bark, Leaves--Chewing Gum, Medicine)

Sweetgum *(Liquidambar styraciflua)* is a tall tree with aromatic leaves which is found in rich wet soil and lowland woods. The aromatic hardened sap that exudes from wounds in the tree has been used as a chewing gum (Peterson 1977:214). English settlers in the southern colonies took early notice of this tree, perhaps because they had heard of it from the Spanish. Hariot mentioned "Sweet Gummes" among the commodities of "Virginia" in 1588 (Vogel 1970:378-380).

It was reported that Native Americans used the resin to cure fevers and heal wounds. In 1795 an explorer wrote: "A Frenchman who traded among the Cheroquis Savages cured himself of the Itch by drinking for ten days a decoction of Chips of that tree he called Copalm and which is the true Liquidambar" (Vogel 1970:380). The resin was also used to treat problems of the lungs, intestines, and urinary passages. The bark and leaves were also used, by boiling in water, for dysentery (Vogel 1970:380).

The Mississippi Choctaws boiled the leaves to apply to cuts. It is interesting to note that the roots were boiled and combined with water in which the roots of Pennywort had been boiled and used as a dressing on cuts and wounds (Vogel 1970:380). Three charred seeds were recovered.

w. Pennywort (Leaves, Root--Medicine)

Pennywort *(Hydrocotyle umbrellata)* is a succulent plant commonly found growing in moist soil along rocks or along ditches and low ground (Harris 1985:117-118). It flowers between July and September (Fernald 1950:1087). As discussed above, Pennywort was mixed with Sweetgum as a medicinal remedy for cuts and wounds. Ethnographic accounts document medicinal usage by the Cherokee and the Choctaw as a poultice for cuts and bruises (Moerman 1986:309). One charred seed was recovered.

x. Smartweed/Knotweed (Seeds--Food; Root, Leaves--Medicine)

There are about 150 species of *Polygonum* which occur in the United States alone (Hatch 1980:207). Knotweeds are members of the buckwheat family and are liabilities as weeds, but they provide a valuable source of wildlife food (Martin 1972:40). Knotweeds *(Polygonum punctatum)* are sometimes called Smartweeds because they contain an acrid juice which can sting the skin. They are partial to moist soil, cultivated fields, and ditches. Knotweed *(Polygonum erectum)* is thought to have been a possible minor cultigen. Knotweed seeds are commonly found in flotation samples from contexts as early as 500 AD (Cowan 1985:217).

Two charred *Polygonum punctatum* seeds were identified from the site area and 55 *Polygonum spp.* which could not be identified to species. Of those, 1 was in the charred state. *Polygonum punctatum* is also called Water Smartweed and occurs in waterlogged ground (Hatch 1980:208). There are numerous ethnographic references to the medicinal use of Water Smartweed. In Virginia Indians it is stated that the juice of the leaves was used for dressing wounds (Erichsen-Brown 1979:218-219). The Meskwaki, Potawatomi, and Ojibwe made a tea from the leaves and stems (Erichsen-Brown 1979:218-219).

Knotweed *(Polygonum erectum)* seeds are the most commonly encountered seed in flotation samples from sites in the lower Illinois River Valley (Cowan 1985:217). Few seeds have been found in pre-Middle Woodland archaeobotanical assemblages (Asch and Asch 1985:183), and investigators are puzzled as to why Knotweed is not present in Archaic contexts. Asch and Asch (1985:186) make the point that Archaic sites such as Koster bear evidence of occupations as intensive and nearly as sedentary as those of Woodland times. If Woodland habitation sites were abundant with Knotweed, so too should have been some Archaic habitations. Evidence for Archaic harvesting of Iva and Ragweed indicated some interest in utilizing small edible seeds (Asch and Asch 1982), and it is unlikely that Knotweed would have been overlooked for exploitation (Asch and Asch 1985:186). The hypothesis of Knotweed cultivation is consistent with evidence concerning its prehistoric economic status and with information about its modern natural distribution and abundance. However the differences between the Archaic and Woodland period archaeobotanical recovery is the subject of continued study (Asch and Asch 1985:1860).

y. Water-milfoil (Leaves--Medicine)

Water-milfoil *(Myriophyllum spp.)* is an aquatic perennial. It is a native of North America and is found in quiet streams or in brackish water. Although it is not an important wildlife food, it is often eaten by ducks (Cox 1985:308). This probably helps disperse its seeds and contributes to its spread. It is not considered edible for humans. However, there is ethnographic documentation that the Iroquois used Water-milfoil medicinally as a stimulant (Moerman 1986:301-302). A total of 8 charred seeds were recovered.

z. Blackberry (Fruit--Food, Bark--Tea, Medicine)

Blackberry *(Rubus spp.)* bushes grow from three to nine feet high. The blackberry is one of the most valuable wild fruits. It grows in some form over almost the entire eastern United States (Medsger 1966:29). Shrub communities are fast to colonize newly opened forest. Shrub communities with a high proportion of fruit bearers would be expected in intermediate stages of succession of lowland forests. Not only were the fruits eaten but also a bark tea was made by the Potawatomi and Ojibwa for coughs and colds (King 1984:154).

Various species of *Rubus* were stored by Native American groups for use during the winter months (Keene 1981:80). The Iroquois used the dry fruit as a cooking condiment and a as trail food. The effort involved in preparing fruit for storage would have been minimal. Rogers (1973:69) reports that the Cree dried berries by boiling them down, spreading the mixture on bark trays, and setting the tray in the sun. This produced a flat cake which could be sliced and eaten. Waugh (1973:127) notes that the Iroquois dried berries both in the sun and on racks spread over fires. Three charred seeds were recovered.

aa. Blue-eyed Grass (Seeds--Medicine)

Blue-eyed Grass *(Sisyrinchium montanum)* is a grasslike perennial with a fibrous root system which flowers between May and July. There are about 10 species of this genus in the Northeast and all are native to the region. The plant is favored by Grouse because of the numerous small seeds (Cox 1985:221). Blue-eyed Grass is found in wet sandy soil. There is ethnographic documentation that the Iroquois used Blue-eyed Grass medicinally for fevers. It is also listed as a physic for elders and no description of preparation is given (Moerman 1986:455).

Muller cites the presence of Blue-eyed Grass at Black Bottom Mississippian sites from Illinois (Muller 1987:263). Muller states that while small seed use in the Black Bottom Mississippian phase is very low and does not constitute a significant percentage of the total botanical assemblage at farmstead and hamlet sites, they may have been used as important seasonal supplements or for special nutrients (1987:262). Seven charred seeds were identified.

bb. Choke Cherry (Fruit, Bark--Medicinal, Food)

Choke Cherry *(Prunus virginiana)* is a native shrub which rarely grows more than 20 feet high. The dark red fruits ripen in July and August but are so astringent as to pucker the mouth and affect the throat if eaten raw (Medsger 1966:49). The astringent quality disappears when cooked. It has a strong, bad odor owing to the hydrocyanic acid in the bark, twigs, leaves, and pits. Hydrocyanic acid contains cyanide, and these plants can poison wildlife as well as humans (Richardson 1981:145-146).

There is extensive documentation of medicinal usage by the Cherokee, Chippewa, Cree, Fox, Iroquois, Mendocino, Menominee, Micmac, Navaho-Ramah, Ojibwa, Potawatomi, and Ponca. Decoctions of bark were used for a variety of health problems ranging from blood disorders, to fever, diarrhea, wounds, coughs, lung problems, and stomachaches (Moerman 1986:375-378). The Potawatomis used the bark in an eyewash and made a tonic drink from the berries (Vogel 1970:389). One specimen was recovered.

cc. Spikerush (Leaves--Medicine)

Spikerush *(Eleocharis spp.)* is a member of the sedge family, which is a perennial matted grasslike herb (Fernald 1970). Spikerush is a low-growing erect herbaceous perennial which thrives in irregularly flooded areas (Tiner 1987:116-117). It was used as a ceremonial emetic by the Navaho-Ramah (Moerman 1987:159). A total of 436 charred specimens were recovered. Spikerush seeds were the second highest in frequency at the site area.

dd. Ground Cherry (Berries, Root, Leaves--Food and Medicine)

Ground Cherry *(Physalis virginiana)* is a widespread annual weed native to America. It is found in moist woods. Each berry contains numerous seeds, but unless fully ripe, the berries have an unpleasant taste and are considered poisonous. The leaves are also poisonous (Richardson 1981:120). After the husk has split naturally and the fruit has attained the ripened color of red or yellow, it is edible. Although wind dispersal plays a role in propagation, a larger role is played by birds, particularly quail, wild turkey, and ring-necked pheasant. It is interesting to note that these berries can be stored successfully, because they will not be bothered by chipmunks, squirrels, or mice (Richardson 1981:120).

There is extensive ethnographic documentation that Ground Cherry was used medicinally by the Fox, Iroquois, Ponca, Winnebago, Omaha, and Kiowa. A decoction of the root was used as a dressing for wounds, stomach problems, and headaches and to induce vomiting. The root was also used in smoke treatment for unspecified ailments (Moerman 1987:335-336). One specimen was recovered.

4. No Evidence of Use

Some plant types have an ambiguous status in the assemblage in the sense that although they are both native and charred, thereby fulfilling the two major criteria, however the extent to which they were utilized in a prehistoric context is not clearly understood. While there is evidence that some Native American groups utilized some of these plants for medicinal purposes, it cannot be assumed that all groups used them in the same fashion. Documentation for historic Native American utilization does not necessarily imply that Archaic populations of Virginia and Maryland utilized the plants (Kavasch 1979). Further, it should be noted that simply because a plant is edible does not imply that it was consumed by all prehistoric populations.

If a plant is both native to America and its seeds are recovered in the charred state, it is analytically considered "background noise" to the assemblage if there is no general usefulness ascribed to the plant or if there is no documented usage of the plant. Weeds were certainly a component of the prehistoric landscape and easily become incorporated into a prehistoric assemblage.

a. Eelgrass

Eelgrass *(Zostera marina)* is a native aquatic grasslike herb (Fernald 1970) which is in the Pondweed family (Tiner 1987:89). It is common to slow-moving streams or brackish waters in Virginia and Maryland. The ribbonlike leaves grow up to two feet long, and the plant flowers in the summer. It is eaten by some species of ducks. Seven specimens were recovered.

b. Waterhemp

Waterhemp is a member of the Amaranthus genus, a very widespread genus, containing some 50 species (Hatch 1980:207). Waterhemp *(Acnida cannabinus)* is a small North American variety which has a general resemblance to nettle but without stinging hairs. It is found on river banks, low grounds and disturbed soil (Fernald 1970:604). Investigators have not considered Waterhemp as one of the Amaranthus whose starchy seeds became economically important. Despite ts name, which implies that it can be used for cordage, there is no reference to confirm that Waterhemp was indeed used in that manner. Indian Hemp is *Apocynum cannabinum* and is not a part of the same family. Eight specimens were identified from the site area.

5. Nutshell

Eight small charred nutshell fragments with a combined weight of 2.2 grams were recovered. The recovered nutshell fragments were so small that they lacked diagnostic features necessary for a species identification. The pollen analysis conducted for this site (Brush 1990) identified oak, hickory, walnut, and hazelnut as being present during the periods of site occupation. Although nutshell is not well represented within the site area, it is possible that nuts or oil derived from nuts were utilized by the prehistoric inhabitants. The nutshells of these species are common to prehistoric archaeological assemblages and it is likely that these valued and reliable food sources served the populations under study.

Hickory nut shells seem to be the one item remaining from food preparation that consistently burned. Apparently aboriginal groups in eastern North America discovered that Hickory shells make an excellent, hot, virtually smokeless fire for cooking (Smith 1985:121). The proportion of

Hickory shell far outweighs other shell types in prehistoric sites of the East. The occurrence of Walnut shell in eastern prehistoric sites is much more sporadic and less consistent.

Oaks vary in preferred environments and yields. Red Oak and Black Oak produce bitter acorns, while the White Oak acorns are sweet. The bitter varieties require additional processing to remove the tannin, which produces the bitter taste (Keene 1981:55). It is reported that the Chippewa preferred the bitter acorns over the sweet ones; this may be because the acorns from the Red and Black Oaks can remain on the ground for months without sprouting, while the White Oak acorns sprout soon after falling (Reidhead 1980). Acorns were gathered in the late fall and buried for later use or were used as soon as they were gathered. They were cooked in three ways: (1) boiled, split open, and eaten like a vegetable; (2) roasted in the ashes; (3) boiled, mashed, and eaten with grease (Densmore 1974:320).

Acorn productivity is influenced by the same factors that affect fruit trees, primarily unseasonally cold temperatures. Red Oaks drop their acorns later than the other Oaks, with nut fall extending into November (Keene 1981). Variance in production between trees is greater than between years. That is, the most productive trees consistently exceed the annual average, while poor producers are consistently underproductive. In terms of exploitation, this implies that after productive trees were identified, they could be harvested annually with a degree of dependability (Keene 1981:62-63). It is most like that Acorns were gathered off the ground. Gathering of acorns would have required precise scheduling, because a large amount of the crop drops within a short period, and human groups would have been in direct competition with wildlife.

Ethnographic accounts dating from the contact period are useful in determining how people may have prepared these nuts. According to early travelers, Indians collected hickory nuts mainly for their oil, although they also ate the nut meats (Swanton 1946:364). An eighteenth-century observer described the extraction of oil as follows:

> At the fall of the leaf, they gather a number of hiccory-nuts, which they pound with a round stone, thick and hollowed for the purpose. When they are beat fine enough, they mix them with coldwater, in a clay bason, where the shells subside. The other part is an oily, tough, thick white substance, called by the traders hiccory milk, and by the Indians the flesh, or fat of hiccory-nuts, with which they eat their bread (Adair 1775:408, as quoted in Swanton 1946:365).

6. <u>Charcoal</u>

All examined samples contained very small charcoal flecks. Flecks, defined as being less than 1 millimeter in length, were too small to extract or weigh. Fragments were defined as being larger than 1 millimeter in length and an attempt was made to count and weigh the small fragments. No large concentration of charcoal was noted for any of the samples, nor could the species of wood be determined.

Wood and charcoal fragments are not direct elements of the diet. Charred wood is resistant to decay and therefore preserves well. Charcoal is commonly found in prehistoric contexts (Carbone and Keel 1985), and large concentrations can suggest the presence of a hearth or fires. Wood, of course, was burned as fuel for fires. Yarnell (1964:27; 1965) discussed the effects of selective firewood-gathering and differential self-pruning of various trees. Unfortunately, the charcoal at the site area was low in frequency and small in size and not amenable to further analysis. In this case, it is the scarcity of charcoal that is notable.

D. FAUNAL ANALYSIS

1. Variables Affecting Bone Survival

Bone, horn, teeth, antler, and shell are the most abundant faunal remains recovered in archaeological investigations. Bone is made up of calcium phosphate, lesser quantities of calcium carbonate, and other trace elements and compounds. The mineral salts impart a rigidity and hardness to the bone, while the organic compounds give it resilience and toughness (Carbone and Keel 1985:1-19). Because of bones' organic content, it is subject to insect, fungal, and rodent attack, both in and out of the soil (Carbone and Keel 1985:1-19). Since microorganisms have been shown to be one of the primary causes of decay, it stands to reason that an analysis of the environmental tolerance of these organisms will give insight into the kinds of situations that are favorable to preservation of animal remains. The conditions that are favorable to preservation are those that are reflected in our daily kitchen rounds. Boiling, freezing, pickling, and salting inhibit decay.

Burned bone indicates direct contact with fire or coals. Burning of bones may result as a byproduct of roasting, or from disposal in a hearth. Accidental or purposeful exposure of bone to fire alters the calcium content of bone. If a fresh bone is burned it does not necessarily alter its shape but it does lose weight and becomes very friable. The destruction of organic material in bone through burning can shrink it from 5 to 15 percent and reduce its weight by 50 percent (Wing and Brown 1979:109).

Heat can result in the blackening of bone. Deeply blackened bone may suggest that flesh was still present during the burning (Chaplin 1971; Cornwall 1956). Charring of bone during roasting is confined to the exposed ends of the bone not protected from the fire by meat. Burning at high temperatures for prolonged periods can leave the bone pure white, friable, soft, and porous suggesting complete oxidation. Some burned bone that is not completely calcined does not reach the fragile state and although light in weight, may be quite strong (Carbone and Keel 1985:7).

Soil acidity has a major influence on bone preservation. If the environment is acidic, the mineral content will be removed. Bone will not survive under conditions where the pH is lower than 6.3. The same holds true for shell. In considering the preservation of bone the effects of humans must be taken into account, because culturally modified bone, whether boiled or cracked, will be more susceptible to environmental forces (Carbone and Keel 1985:14). The effect of the chemical environment on teeth is somewhat muted because dentine, although chemically similar to bones, contains less organic matter and more phosphate and carbonate. Enamel, which is the hardest component of teeth and contains the least organic matter, is still more resistant. Teeth will be affected by acidic conditions in the soil but are more likely to be found preserved, although generally they will be somewhat etched (Carbone and Keel 1985:14).

2. Recovered Specimens

It is likely that the pH levels of the soils at the site area are the major variable responsible for the paucity of recovered bone. The pH values ranged from 3.9 to 5.9, with a mean of 4.5 (see Table 2). None of the samples at the site reached the pH value of 6.3, which is considered minimum for bone preservation. This critical factor explains why only 10 bone specimens were recovered from the site area. The 10 recovered faunal specimens represented pig, rabbit, bird, and mammal. It is likely that all of the recovered faunal material is modern, because the pH levels are unfavorable to long-term bone preservation

One rabbit carpal/tarsal was identified from Unit 79 in Excavation Block 1. Rabbit live in a wide variety of habitats but prefer areas of dense brush, swamp margins, and open forest (Keene 1981:108). Rabbits are primarily solitary animals. Although they have a limited home range, their mobility increases during the February to March breeding season. There are erratic population fluctuations. Rabbits are quite prolific but are heavily preyed upon. It has been estimated that 75 percent of the population is lost each year (Keene 1981:108). Rabbits may have been captured by snares, but Keene reports that the Huron had limited success in trapping rabbits because the animals easily broke or cut through the snares (Keene 1981:108).

Two bird longbone fragments were recovered from Block 4, one from Unit 72 and one from Unit 108. Although the species of bird could not be determined, the two fragments may represent waterfowl, which prosper in wetlands. While they vary by species in population fluctuations and in the regularity with which they return to the same breeding grounds, they may be considered a stable resource (Keene 1981:117). Both archaeological and historical reports attest to the use of waterfowl and birds in eastern North America. It is quite likely that the prehistoric population at the site area exploited birds, and the lithic residue analysis (see Appendix Q) supports this argument.

Seven mammal bones were recovered. One of the specimens can be eliminated from the prehistoric assemblage: a pig metatarsal epiphysis that had been butchered by modern equipment. This was definitively modern and intrusive. Two small charred non-diagnostic fragments were recovered from Unit 65; both were less than 1 centimeter in length and it could not be determined what element they had comprised. A molar fragment from a small mammal was recovered from Unit 57. Three charred longbone fragments were recovered from Unit 135.

E. Floral Exploitation Strategies

Table 26 indicates the seasonal availability of the nuts, tubers, starchy seeds, roots, shoots, leaves, and fruit. Some of the plant types fall into more than one category. For example, Bulrush is comprised of tubers, shoots, leaves and starchy seeds and is therefore repeated in each appropriate category. The data are summarized in this fashion because more than one element of the plant may have been used, and more importantly, the various elements may be available at different times of the year.

A total of 83 percent of analytically significant floral specimens possess tubers as a plant part constituent. Tubers and rootstocks were most likely abundant in the wetland areas adjacent to the site. Historically tubers were important plant foods to the aboriginal populations in the Eastern Woodlands (Hamel and Chiltoskey 1975; Kavasch 1979). Tuberous plants abound in damp habitats such as swamps, stream edges, riverbanks, and moist woods.

The investment of time and effort required for collecting tubers varies. Some species aggregate, while others are more dispersed. Some species require considerable excavation while others may be easily gathered (Keene 1981:85). The amount of processing required also varies by species. Prior to consumption Generally, tubers are generally boiled or roasted. In most instances, processing for storage would have been incidental to preparation for consumption (Keene 1981:85).

Tuberous plants were available in early spring and late autumn. However, Chufa, Scleria/Nutrush, and Flatsedge were available throughout the year. Most aquatic tuberous plants produce more than one tuber per plant. Keene (1981:83-85) estimates an average yield of 5 mature tubers per plant.

Along the streams and creeks, edible greens would have been abundant. Many of the tubers also possess edible shoots and leaves as a constituent part. Edible greens tend to exhibit a scattered but dense distribution. Keene reports that densities for greens is high in terms of stems per acre and these resources would have been sufficiently abundant. Search time would not have been a major component in the cost of acquisition. In addition to this, the cost of processing would have been minimal, consisting of leaf stripping and cooking (Keene 1981). Greens would have provided a good food source for a minimum investment of time and energy.

Starchy seeds have a very high utility but have a relatively high processing cost. More intensive labor is needed for collecting and processing starchy seeds than any other wild plant food.

Although seed-bearing weeds require relatively high processing costs, they would also be a relatively predictable and abundant resource requiring a low expenditure for their search and pursuit (Keene 1981:90). Weedy genera require no thinning, watering, fertilizing, planting, or hoeing in order to achieve significant stands, and therefore the maintenance expenditure is quite low (Hatch 1980). One of the most important aspects of the opportunistic plants is that the seeds are most efficiently harvested after the first killing frost, when other plant foods are scarce.

Humans would have been in direct competition with wildlife for fruit and nuts. Reidhead (1980) notes that production of fruit-bearing shrubs would not have had to be very high to allow economic utilization. Because most tend to dense stands or thickets and are relatively consistent over the short run, productive localities could be exploited repeatedly without a major search costs (Keene 1981:80-81).

Not all fruits are suitable to storage. Blackberries were commonly stored by native populations of the Great Lakes region for use during the winter (Keene 1981:80). The Iroquois used dry fruit as a cooking condiment and as a trail food. The effort involved in preparing fruit for storage would have been minimal. The Cree preserved berries by boiling them down, spreading the pulp on bark trays, and setting the tray in the sun to dry. This produced a flat cake which could then be consumed (Keene 1981:81). Waugh (1973:127) indicates that the Iroquois dried berries both in the sun and over fire.

The processing of nuts involves collecting, hulling, shelling, and preparation. Keene (1981) developed a rank order for nuts depending on the time and energy expended to perform these processing functions. Keene determined that Black Walnuts would be the least expensive to collect because of their large size and high per tree yields. However Black Walnuts would be more time consuming to shell because of their thick hulls. Acorns would have a higher initial collection cost than Black Walnut because of their smaller yield per plant and smaller size, but a lower marginal cost, and they could be efficiently collected in large quantities (Keene 1981:71). Keene (1981) ranked Hickory as the most efficient nut to collect and process.

Plant material was also exploited for medicinal purposes. Prehistoric populations understood and utilized the natural resources of their environment. An early report on Indian medicine relates:

> Although the Indians, being without the advantages of science to guide them in their choice of remedies, and treatment of diseases, derive their principles from mere experience, it is certain we are indebted to their materia medica for many valuable articles of a vegetable kind . . . (Winder 1846:11 as quoted in Erichsen-Brown 1979:278).

Medicinal barks were so generally available that they were usually gathered when they were needed (Densmore 1974:327). Bark is not listed in Table 26 because it is assumed that it was available all year long.

The part of the plant most frequently used medicinally was the root. Most roots could be gathered all year, but it is easier to gather roots when the plant is in bloom, because they can then be identified more readily. Unless references specifically noted that roots of a particular plant were gathered all year, then they are listed in Table 26 for the period of growth when they would have been the most recognizable.

Many ethnographic accounts refer to root preparation and storage. Roots intended for later use could be pulverized and stored in that form. Certain roots, when used, were broken into short pieces and boiled or steeped, but a majority were prepared for use either by pounding until they were in shreds or by pulverizing them in the hands. The most common method of pulverizing roots was to place them in the palm of the left hand and then to rub them either with the thick portion of the right hand below the thumb or with the fingers of the right hand (Densmore 1974:326). If several roots were to be used in combination, they were usually pounded together in order to blend them. Poultices were made by moistening the pounded fresh or dry roots or herbs (Densmore 1974:329).

If stalks, leaves, or flowers were to be used as remedies, they were dried by hanging them with the top downward and kept as clean as possible. After drying, they could be stored. Stalks, leaves, and flowers were usually pulverized in a similar manner to the preparation of roots. Vegetable substances were further prepared for use by combining them with water. Some were boiled a few moments, others were allowed to come to a boil, then removed from the fire, and others were scalded or steeped.

Native Americans smoked many plants long before they smoked tobacco and they continued to smoke these plants after they could obtain tobacco (Erichsen-Brown 1979:vi). They smoked to please the spirits upon whose goodwill their existence depended. Smoking, drinking, and chewing decoctions of plant materials produced narcotic effects. The Native Americans also smoked plants for their medicinal properties, and some plants were smudged on the fire to drive away insects or to serve as purifiers.

F. Faunal Resource Exploitation

It is important to consider the faunal resources that potentially could have been exploited. The acidity of the soil at the site is not conducive to bone preservation, and it is concluded that the recovered bone does not accurately reflect the site occupants' faunal exploitation. The numerous projectile points in the lithic assemblage suggest the importance of hunting, and the site's immediate environment would have been rich in migratory birds as well as small and large game. This argument is further enhanced by the blood residue study (Newman 1990), which showed positive results for deer, rodent, bird, fish, bovine, rabbit, dog, and bear.

Historically, deer was the most important game species in eastern North America, and numerous researchers have argued that it was the foundation of the eastern Archaic economy (Keene 1981:101). Deer have adapted to a wide variety of habitats, and they especially favor swamps, forest borders and cedar glades (Keene 1981:101). Deer density is linked to availability of food and the degree of predation. It is estimated that white-tailed deer densities range from 10-80 per square mile in the Eastern Woodlands (Shelford 1963:26). Intentional burning of forest at regular intervals would have an effect on the composition of plant communities, and would increase the environment's carrying capacity for deer. Mellars suggests that the burning of woodland areas would increase deer productivity by a factor of 10, and he further argues that prehistoric hunters intentionally burned forest areas to increase deer populations (Mellars 1976).

The white-tailed deer is not a gregarious animal but it does form small groups. The home range for deer is small, perhaps no more than 0.12 to 2.6 of a square kilometer. Deer follow two annual migrations, one in early winter and another in late spring (Keene 1981:102). Their movements are predictable, and they tend to return to the same ranges year after year. In summer, they form loose groups of two to four, although the bucks may be solitary. In winter, deer sometimes form bands at favorite feeding grounds, but aggregations are largest in the fall just prior to rut.

Ethnohistorically, deer were taken throughout the year, but most intensively in the fall (Keene 1981:104).

In addition to deer, the site inhabitants would have had access to rabbits, bear, porcupine, chipmunk, raccoons, skunk, squirrels, muskrats, turtles, fish and a range of birds. The faunal assemblage did not lend itself to delineation of the variety of all resources exploited.

G. Data Assessment

Botanical specimens occur naturally and only become artifacts when they are utilized or impacted by man. One method used in this analysis to distinguish contemporary environmental specimens from prehistoric artifacts was the use of five control samples collected from beyond the bounds of the delineated site area. The five control samples were located at least 1,000 feet to the east of Area 3 which was the focus of the investigation. The off-site samples were compared to the samples from within the site area. The logic of this comparison was that a culturally impacted environmental area should exhibit a different botanical assemblage from a non-culturally impacted environmental area. The data were examined to discern differences of deposition, preservation and recovery rates between the two areas.

The volume of processed soil was used as the constant against which other variables could be measured. The assumption is that all things being equal, larger sediment samples will have more plant remains. Calculation of frequency of seeds per liter of processed soil allowed all samples to be comparable.

Table 27 delineates the floral material recovered from the control samples. The five control samples comprising a total of 10 liters of soil contained a total of 46 seeds, with a mean recovery of 5 seeds per liter of sampled soil. The average seed recovery from the site area was 23 seeds per liter of tested soil. The site area samples contained, on average, approximately five times as many seeds as did the off-site samples.

TABLE 27. CONTROL SAMPLE FLORAL ASSEMBLAGE.

		CONTROL SAMPLES				
BOTANICAL NAME	COMMON NAME	1	2	3	4	5
Brassenia schreberi	watershield	2	.	.	.	.
Digitaria sanguinalis	crabgrass	.	1	.	.	.
Euphorbiaceae	spurge	.	.	.	1	.
Indigofera spp.	indigo	.	.	.	1	.
Nyssa sylvatica	blackgum	.	.	.	2	1
Phytolacca americana	pokeweed	.	1	.	.	.
Picea engelmanii	spruce	7	.	.	.	.
Polygonatum commutatum	Solomon's seal	.	1	.	.	.
Potamogeton spp.	pondweed	.	2	1	.	.
Quercus sp.	oak	.	1	.	.	.
Rhus spp.	sumac	1	.	**16**	.	.
Rubus spp.	blackberry	.	1	2	.	.
Sambucus canadensis	elderberry	.	.	1	.	.
Scripus spp.	bulrush	.	.	1	.	.
Zostera marina	eelgrass	.	.	3	.	.

Note: number in boldface indicates charring.

The recovery of charred seeds was also compared between the site area samples and the off-site samples. The off-site samples contained an average of 0.62 charred seeds per liter, while the charred seed recovery for the site samples was 15.5 charred seeds/charcoal per liter. The site area samples contained, on average, approximately 15 times as many charred seeds as did the off-site samples.

Indigo, Blackgum, and Elderberry were recovered from the control samples but not from the site area samples. Spruce, Watershield, Pokeweed, Sumac, Pondweed, Blackberry, Crabgrass, Oak, Solomon's Seal, Eelgrass, Bulrush, and Spurge were recovered from both control samples and on-site samples; however, these species were recovered in the charred state from the site area and in the non-charred state from the off-site samples. The on-site samples exhibited a greater variety of plant species and higher frequencies on average per sample than did the off-site samples. It is important to note that Fern, which had the highest recovery frequency at the site area, was not recovered from the off-site samples.

Perhaps the most significant difference between the samples is that charred seeds were recovered from almost all on-site samples and from only one control sample (Control #3). This suggests that the mechanisms for on-site charring were not the same for the off-site area, enhancing the argument that cultural activities were responsible for the charred botanical material recovered from the site area.

The application of statistical procedures to seed material must be undertaken with caution because of the vagaries of preservation and the general difficulties associated with quantitative analysis of seeds. However, proceeding with caution is preferred to the assumption that seeds are not amenable to anything but rudimentary quantification.

Of the total charred and native, and hence potentially prehistoric, floral assemblage, less than 1 percent is categorized as nonedible plant material. Nearly all (99.8 %) of the recovered charred specimens represent edible foodstuff or plants with medicinal value. While this does not imply that each plant species was utilized by the prehistoric population, it does suggest that a great deal of edible/medicinal plant food was available to the population. It was thought that the figures might be skewed by the high frequency of fern macrospores, which comprise 81 percent of the native charred plant assemblage. However, if the ferns are excluded from calculation, 1 percent of the charred seed is considered nonedible and 99 percent is considered potentially utilizable plant food.

Although there is no available model from which to assert that a particular environment will have a given proportion of potentially edible seeds which could appear in an archaeological assemblage, simple statistical reasoning may be applied. Using a population of 6,730 charred native seeds (excluding charcoal) and samples of 15 inedible/non-medicinal seeds and 6,715 potentially edible/medicinally useful seeds, the following hypotheses are tested:

Ho: edible and nonedible seeds appear in the assemblage at random

H1: edible seeds appear more frequently because they were utilized at the site area

Using simple probability distributions and assuming that the probability of edible and nonedible seed types occurring at random at the site would be equivalent (i.e., 50 % each), the results indicate that the seed types do not appear at random or follow the normal curve. Nonedible/medicinal seeds lie 0.5 standard deviations below the expected norm and edible seeds lie 871 standard deviations above the expected norm. This suggests that the null hypothesis should be rejected and indicates that there are far more seeds of edible/medicinal plants in the site assemblage than would be expected by chance. This result in turn enhances the argument that cultural behavior was an important factor in the formation of the site's botanical assemblage.

TABLE 28. UBIQUITY SCORES BY FEATURE.

SPECIES	FEATURES																												SCORE
	2	3	6	8	9	10	11	12	13	14	15	16	17	18	19	20	21	23	25	26	27	28	29	30	31	32	33	35	36	
Bedstraw	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*
Blue-Eyed Grass	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*
Bulrush	.	X	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	10%
Burreed	.	.	.	.	.	.	.	.	.	.	.	X	X	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	10%
Catchfly	.	.	.	.	.	X	.	.	X	.	X	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14%
Eelgrass	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*
Fern	X	X	.	.	X	.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	.	X	X	X	86%
Goosegrass	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*
Ground Cherry	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	*
Hercules' Club	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*
Nutshell	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*
Pennyroyal	X	.	.	X	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10%
Poison Ivy	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*
Solomon's Seal	.	.	.	.	.	X	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7%
Spikerush	.	.	X	.	X	.	.	X	.	X	.	.	.	.	.	.	X	.	X	.	.	X	.	.	.	.	X	.	X	31%
Spurge	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*
Sumac	.	X	.	.	X	.	X	X	X	.	X	.	X	.	.	.	.	X	X	X	.	.	.	X	X	.	X	.	.	45%
Sweetgum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*
Thistle	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*
Water-milfoil	.	X	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	*
Watershield	X	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	X	.	.	.	X	.	.	X	.	.	X	.	.	21%

X: present.
*: Fewer than 2 occurrences of taxa.

Nearly all of the features in the site's primary habitation area are comprised of fire-cracked rock. Feature 6, a circular stain with charcoal, differs from the others, and only one charred Spikerush was recovered from it. Features 4 and 5 were categorized as lithic workshops, but neither of these features contained any botanical material.

A ubiquity index was constructed to further understand the botanical data within the features (Table 28). This index measures the number of samples in which the species appears within the population of features, disregarding the absolute count of a species. Each species is scored only on the basis of presence/absence, regardless of whether the sample contains a single seed or 100 seeds (Popper 1988:61). The score of a species is determined by the number of samples in which the species is present, expressed as a percentage of the total number of samples. The score of one species does not affect the score of another, so that the scores may be evaluated independently. A species must be present in at least two samples to provide a valid score, and the ubiquity index (see Table 28) notes the presence of single-occurrence species but does not compute a score.

Ubiquity scores were compared between features and units to examine whether there was patterning in features that was not evident in the more generalized unit contexts. The ubiquity index scores when compared between features and units are quite similar. Fern, Spikerush, Sumac, and Watershield exhibit high indexes in both units and features. Although only 17 percent of the charred material was recovered from defined features, Fern has a ubiquity score of 86 percent within features, having been recovered from 25 of the 29 features. Fern has a ubiquity index of 87 percent for the units, and it was recovered from 48 of the 55 units that contained charred material. The ubiquity index scores suggest that charred fern is not concentrated in features. Spurge and Bulrush have higher ubiquity scores in the units rather than in the features.

Examination of the data according to distribution within the site (Table 29) indicates considerable variation within the site and between the site and the off-site samples. Within the site, the lowest recovery of charred seeds was from Blocks 2 and 3, the only excavation blocks that did not contain FCR features. The highest charred seed recovery was from Blocks 1 and 6, where there was also a relatively high density of FCR features. A scatterplot (Figure 113) of charred seed recovery against densities of FCR (including feature and non-feature contexts) exhibits a generally positive relationship between these variables, again enhancing the argument that prehistoric cultural activity is at least partially responsible for the formation of the site's botanical assemblage.

TABLE 29. CHARRED BOTANICAL MATERIAL BY EXCAVATION BLOCK.

EXCAVATION BLOCK	VOLUME OF FLOTATION SAMPLES (liters) N	%	NUMBER OF CHARRED SEEDS N	%	CHARRED SEEDS/LITER	FCR WEIGHT/5X5-FT UNIT (kg)
1	28	6.4	891	13.2	32	3.138
2	3	0.7	0	0	0	1.299
3	8	1.8	125	1.9	16	1.643
4	102	23.4	1,508	22.4	15	2.691
5	102	23.4	513	7.6	5	3.302
6	190	43.7	3,707	55.0	20	3.753
7	2	0.5	1	*	1	1.333
SITE TOTAL	435	99.9	6,745	100.1	.	.
CONTROLS	10	.	16	.	2	.

*: less than 0.1 percent.

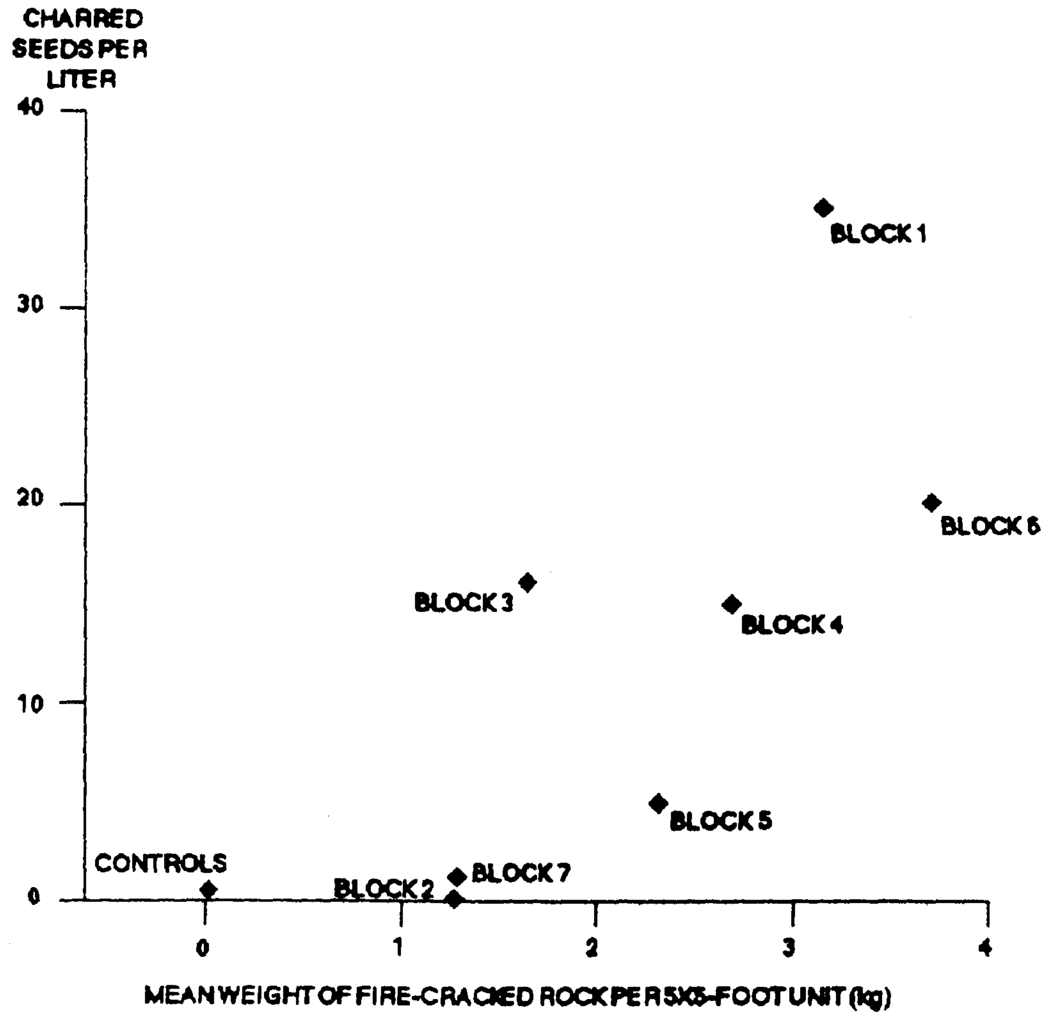


FIGURE 113: Scatterplot of Charred Seed Recovery Against Fire-Cracked Rock Density

H. CONCLUSION

A large analytically significant botanical assemblage was recovered from the Indian Creek Site representing a wide variety of fruit, tubers, starchy seeds, nuts, shoots, and leaves. Botanical data present a unique set of interpretive problems, and it does not necessarily follow that all charred seeds represent plants that were consumed or intentionally used by the site occupants (Holt in press; Keepax 1977; Minnis 1981:145; Moeller 1986; Smith 1985). Off-site control samples differed significantly from the on-site samples, in terms of species representation, diversity, and overall specimen frequency, as measured by the number of charred seeds per unit of volume. Differences between the on-site and off-site samples, together with the fact that nearly all charred native specimens were recovered from the site, provide a convincing though not compelling argument that the Archaic hunter-gatherer groups that occupied the Indian Creek Site used a broad array of the plant resources available in the floodplains and wetlands surrounding the site. Aside from dietary consumption, many of the plant taxa identified in the assemblage have ethnographically documented uses as medicine, smoking material, insect repellent, etc.

The on-site samples exhibited a greater variety of plant species and higher frequencies on average per sample than did the off-site samples. Charred Fern had the highest recovery frequency at the site area but was not recovered from the off-site samples. Examination of the two data sets suggested that indeed the delineated prehistoric site area contained a botanical assemblage that differed from the selected off-site assemblage. The major difference between the control samples and the on-site samples is that charred seeds were recovered from almost all on-site samples whereas charred specimens were recovered from only one control sample. This finding suggests that the mechanisms for on-site charring were not the same for the off-site area.

The recovered botanical data represent a broad range of potentially utilized plant resources. The recovery of numerous potentially edible and medicinally valued plants does not necessarily mean that all were culturally perceived or regularly utilized as important food or medicine. However, nearly all (99.8 %) of the charred native specimens have potentially exploited tubers, greens, rootstock or starchy seeds.

A variety of food plants were recovered from the site area, including tubers, greens, berries, seeds, etc. Tubers were well represented within the samples, and they can be eaten raw, cooked, or ground into a flour and some were available all year long. Berries, greens, and seeds available in the spring and fall which could be utilized for food and beverages were well represented. The plant material recovered from the site area suggests a variety of uses beyond subsistence. Leaves and roots used as a smoking material were well represented at the site area. Roots and leaves with extensive ethnographic documentation as medicinal in value are well represented within the samples. Leaves and roots could be collected and dried for year-round use. Plant types which could have been used to make dyes and baskets or to line sleeping or fire pits were also well represented.

The recovery of charred Knotweed/Smartweed is a provocative find, as is the recovery of Ragweed, because of the early archaeological context. All of these plants exhibit a preference for disturbed habitats, and their presence in the climax vegetation that covered a large portion of the prehistoric eastern United States must have been limited. The necessary disturbed habitat largely results as a consequence of natural forces such as fire, flooding, ice heaving or storm damage, and human activities (Hatch 1980:209). Clearing of land by fire was practiced by many aboriginal groups in eastern North America (Day 1952). The increase in hunter-gatherer populations through time provided the potential for an increase in disturbed areas favored by Chenopods, Amaranths, and Knotweed. Archaeological information from the eastern United States supports the notion that populations did increase in size and density during the Archaic period, and weed seeds are found in

Late Archaic archaeological contexts as well as with the remains of later agricultural populations (Hatch 1980:209).

While there is evidence for the use of plant food during the Archaic period (Schoenwetter 1974), the actual appearance of Amaranths, Chenopods, Knotweed, and other weedy plants does not occur until Late Archaic or Early Woodland archaeological contexts. Comprehensive reviews of the arguments for cultivation of Chenopodium by indigenous Americans are presented by Asch and Asch (1977), Struever and Vickery (1973), and Yarnell (1965). These researchers support the notion of the propagation of weeds for food, but their positions differ regarding the degree of active cultivation. The idea of encouragement versus domestication is one of the central problems of interpretation involving weed seeds and their positions in the subsistence strategies of prehistoric eastern North America. The emerging picture is one in which most researchers agree that weedy plants were manipulated by human groups but few agree on the nature and degree of such manipulation. There is a wide variety of possible strategies for utilizing starchy weed seeds as a food source, ranging from the collection of wild stands to intensive cultivation, with many gradations between these two points. It is probable that these strategies underwent a good deal of change over time and space as population growth and the framework of subsistence changed (Hatch 1980:210). The specific subsistence position of the weedy genera is currently the subject of increased attention and debate, and there are numerous questions pertaining to the identification, productivity, availability, and usage of these weedy grains. Peterson and Munson (1984:317-337) present a comprehensive explanation and summary of the problems surrounding the inclusion of Pigweed, Goosefoot, and Knotweed as prehistorically utilized food.

A small amount of bone was recovered from the site area. In situations of high soil acidity (low pH), bone and shell are poorly preserved but organic matter is well preserved. It is likely that the pH levels of the soils at the site are the major variable responsible for the paucity of recovered bone and the high frequency of recovered botanical remains.

X. SYNTHESIS AND CONCLUSION

This chapter synthesizes the results of the data recovery program with specific reference to the project research design and the information needs outlined in Maryland's Comprehensive Historic Preservation Plan (HPP). Maryland's HPP identifies a number of themes for the prehistoric period, including subsistence, settlement patterns, political organization, demographics, religion, technology, and environmental adaptation (Maryland Historical Trust 1986:251-258). The project research design explicitly addressed the subsistence, settlement pattern, technology, and environmental adaptation themes, although it should be recognized that much of the information gained from this study crosscuts the themes defined in the state plan. While the themes in the HPP provided a suitable framework for assessment of the site's scientific value, the information gained from this study may be presented more clearly according to the issues of chronology, subsistence, environmental adaptation, settlement patterns, lithic technology, and intrasite patterning. Following a discussion of these anthropological issues, the chapter concludes with a brief discussion of issues related to the future treatment of archaeological resources similar to the site presently under study.

A. CHRONOLOGY

When the project research design was initially developed, it was not anticipated that the excavations would produce important results in the area of chronology. To some extent these expectations have been borne out, as the excavations did not produce a stratigraphic sequence or new radiocarbon dates for some of the projectile point types that are poorly dated in Maryland and the surrounding region. There is still a pressing need for basic information pertaining to the Archaic period chronology (cf. Wesler 1983). However, the recovery of a large sample of culturally diagnostic artifacts from a single site permits reconstruction of a site-specific chronology that may serve as an important frame of reference for the generalized regional chronological sequence. Also, the recovery of a well-preserved pollen core has allowed discussion of the site chronology within a context of detailed environmental reconstruction. In many cases, regional chronologies have been constructed on the basis of a hodgepodge of data derived mostly from numerous small survey and testing projects and museum collections. Most archaeologists would agree that a large sample is preferable to a small sample; hence the impetus to use whatever data are available for the construction of chronological models. The inherent limitations and biases of museum collections and small projects are well known, but it is preferable to develop chronological models on the basis of available data with known biases than to avoid the issue entirely.

The Indian Creek Site chronology spans the entire Archaic period, with two intervals of intensive site occupation (Figure 114). The initial occupational episodes, represented by the Palmer, Kirk and bifurcated-base points (LeCroy, St. Albans, Kanawha, and Stanly) represent the Early Archaic occupation at the Indian Creek Site. Radiocarbon dates for these points suggest that the initial occupations occurred between circa 7800 and 5300 BC. The second interval of occupation spans the Late Archaic period, extending from circa 4000 to 1000 BC, based on the date ranges for the Morrow Mountain II, Brewerton/Otter Creek, Vernon/Halifax, Clagett, Savannah River, Lackawaxen, Holmes, and Calvert points. There is no evidence of site occupation during the period from circa 5500 BC to 4000 BC, an interval which falls in the Middle Archaic period. Many of the points representing the second occupational interval, the Late Archaic, have a limited regional distribution and are not securely dated. In particular, there are no radiocarbon dates for the Vernon/Halifax points which are the most common point type in the site collection. The Vernon/Halifax points have been placed in the Late Archaic, with an estimated date range from circa 3500 to 2300 BC, however it is possible that these or some of the untyped points in the assemblage may date to the Middle Archaic.

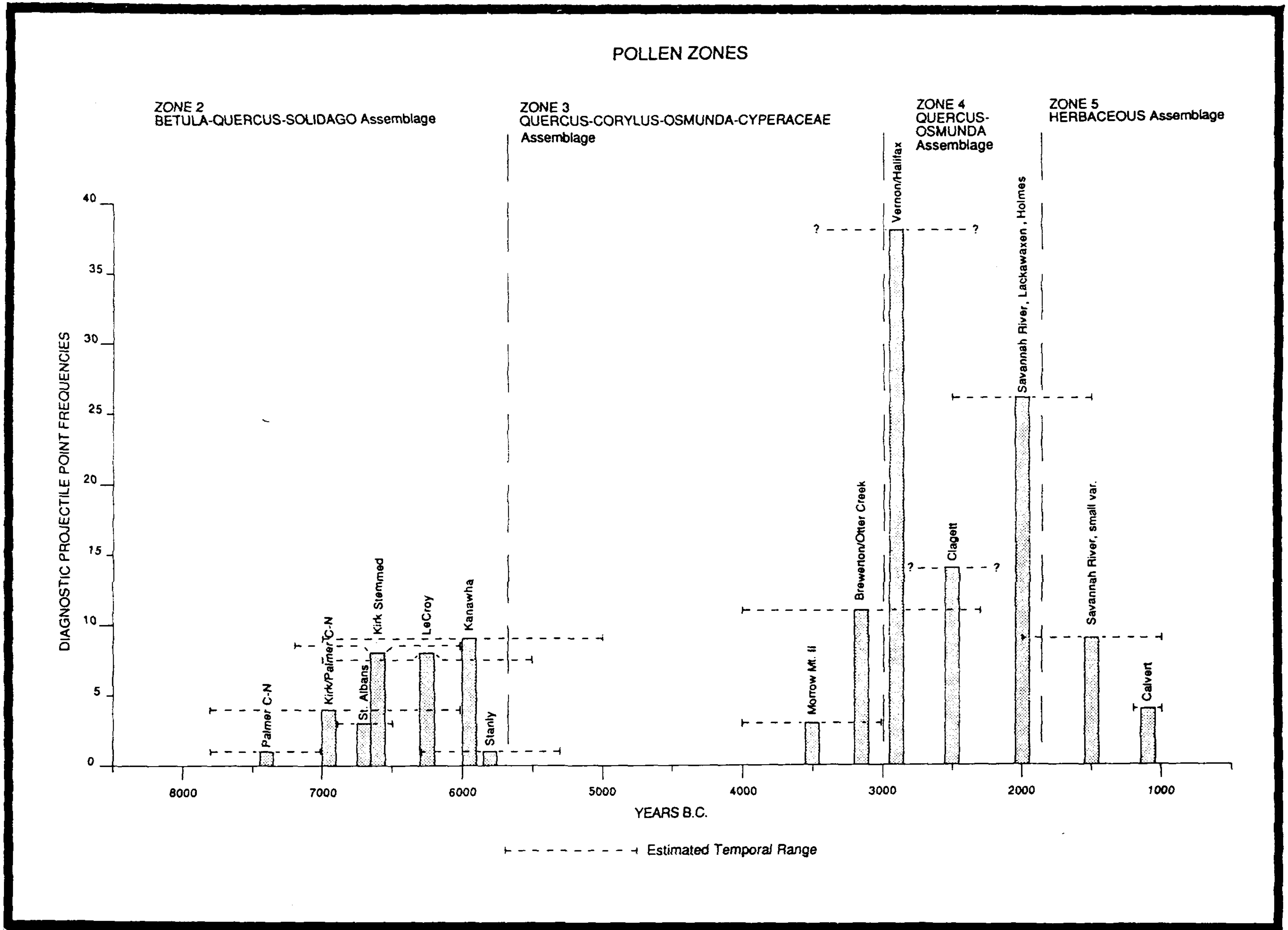


FIGURE 114: Cultural-Environmental Chronology

Primarily because of a paucity of radiocarbon dates and stratigraphic evidence, there is a lack of unanimity among archaeologists regarding the Archaic period chronology in the Middle Atlantic region. In particular, the division between the Early Archaic and Middle Archaic periods is in disagreement. Some archaeologists, including Gardner and his students, see a cultural discontinuity between the corner-notched point phases and the bifurcate-based point phases, placing the latter in the Middle Archaic and setting a terminal date of circa 6500 BC for the Early Archaic (Custer 1990; Gardner 1987; Stewart 1990). Others place the bifurcate phase in the Early Archaic, as is more commonly done in the Southeast, and bracket the Middle Archaic to the interval from circa 6000 BC to 4000 BC (Steponaitis 1980; Wanser 1982; Wesler 1983).

While there are significant differences in technology and raw material selection between the bifurcate-based points and the Palmer and Kirk points, published radiocarbon dates and stratigraphic evidence indicate that there is considerable temporal overlap among these points. Therefore, the bifurcate-based points are included with the Palmer and Kirk points in the Early Archaic occupational component at the Indian Creek Site. Archaeologists in the region have traditionally divided the Archaic into Early, Middle, and Late subperiods, although some have argued that new chronological frameworks are necessary (e.g., Custer 1984; Johnson 1986). The traditional tripartite division of the Archaic into Early, Middle and Late sub-periods is particularly applicable to the Indian Creek Site chronology. These divisions correspond fairly well not only to the site's two intervals of occupation (Early Archaic and Late Archaic), separated by an interval of abandonment (Middle Archaic), but also to the local paleoenvironmental history as reconstructed from the DB-6 pollen core.

The Archaic period represents the longest chronological unit of human occupation in the eastern United States, but very little is known about cultural development during the seven millenia that followed the end of the most recent ice age. Caldwell's (1958) primary forest efficiency model posits a period of increasing familiarity with the environment which allowed more efficient exploitation of seasonally abundant food resources and which ultimately permitt an increase in population and greater social complexity. Following this model, the Archaic has been viewed traditionally as a period of gradual, steady population increase.

The Indian Creek Site chronology is clearly at variance with a model of gradual, steady population increase, if one accepts the assumption that the number of diagnostic projectile points is directly related to population size. Rather than a stable or slowly expanding population, the site chronology suggests a virtual depopulation during the Middle Archaic. Admittedly, the Indian Creek Site assemblage represents a sample of an area less than two acres in size. One must consider the alternative hypothesis that population remained stable and that the site's interval of depopulation resulted from changes in the environment and subsistence patterns that made other areas in the region more attractive for occupation. However, there are almost no radiocarbon dates from archaeological sites in the Middle Atlantic region that fall in the period from 5000 to 4000 BC, and projectile point types that are dated to this period are very scarce (Gleach 1987). Particularly for the Chesapeake Bay region, one must also consider the possibility that evidence of Middle Archaic activity has been drowned by rising sea levels. These issues of regional chronology cannot be examined fully in the context of a single site report. It is argued here only that the Indian Creek Site was abandoned during the Middle Archaic. This may or may not be viewed as evidence of regional demographic change, but it does not support the model of steady or gradually expanding population levels during the Archaic period. Elsewhere in the Maryland Coastal Plain, Steponaitis (1980) and Wanser (1982) have noted an apparent scarcity of components dating to the 6000-5000 BC interval.

B. SUBSISTENCE

Archaic cultures in the eastern United States are generally characterized by a subsistence economy that combined hunting, fishing, and gathering of plant foods. Cleland's (1976) "focal-diffuse model" has been widely used in the interpretation of the changes in subsistence patterns that occurred during the Archaic period. Paleoindian technology, characterized by a tool kit that seems oriented quite narrowly toward exploitation of herd animals, is viewed as a focal adaptation. The ensuing Archaic adaptations, with a greater variety of site types and tool kits, are seen as diffuse adaptations, with a subsistence base that included a broader variety of floral and faunal resources. Food production, exemplified by the intensive use of corn and other domesticates during the Woodland period, is seen as a Late Focal adaptation, according to Cleland's model (Cleland 1976).

Aside from Late Archaic shell midden sites in the estuarine zone, there is very little specific archaeological information pertaining directly to Archaic subsistence patterns in the Middle Atlantic Coastal Plain, and many of the existing models of subsistence behavior are based on the inferred resources associated with individual site environments (Wesler 1985:219). While the traditional Archaic hunter-gatherer subsistence model posits seasonal gathering of plant foods, botanical material has rarely been recovered from archaeological contexts in the region, and the current understanding of Archaic subsistence largely emphasizes the importance of animal foods.

The results of excavation at the Indian Creek Site illustrate many of the difficulties archaeologists face in the interpretation of Archaic subsistence. The recovery of numerous projectile points provides indirect evidence that hunting figured prominently in the overall subsistence strategy; however, the preservation of bone was virtually nonexistent. The few faunal items that were recovered doubtless entered the archaeological record during historic or recent times, as the high soil acidity levels would have precluded survival of any faunal remains associated with the site's prehistoric occupation.

Recently developed techniques of blood residue identification have raised the expectations of archaeologists that much new subsistence information would be forthcoming. The results in this area have not yet matched initial expectations, and the application of these techniques to archaeological collections has not yet approached the level of forensic science. Residue analysis of the Indian Creek lithic assemblage suggests a faunal exploitation strategy that emphasizes large game species (deer and bison/elk) but also includes various other animals such as rabbit, bear, porcupine/beaver/squirrel, canines, fowl, fish, and rodents. At a general level the residue analysis results conform to commonly accepted Archaic hunter-gatherer subsistence models.

However, the blood residue tests have called into question archaeologists' common notions regarding stone tool form and function. Selection of the lithic specimens that were submitted for testing was guided in a large measure by the assumption that tools such as projectile points and formalized scrapers would yield the greatest amount of subsistence information. More than 500 specimens were tested at the initial presence/absence level, and this sample of the assemblage was heavily biased toward inclusion of formal tools. The remainder of the sample consisted of debitage, some of which was included as a control sample and some of which was selected because of size and formal characteristics that suggested potential use as expedient tools. The unexpected result of the analysis was the infrequency of blood residue on points and scrapers and the large amount of debitage that tested positive.

Although the test results suggest that visual inspection is not adequate to identify expedient tools in a lithic assemblage, it is important to appreciate that the processes by which animal residues might come in contact with a given lithic specimen extend beyond the slaying and butchering of an animal. Any tool or debitage discarded in an area that was subsequently used for butchering might come in contact with blood from a slain carcass and ultimately yield a positive test result. Therefore the assumption that all lithic specimens that yield positive test residue results were used as tools is no more erroneous than the assumption that a positive reaction for a particular species implies cultural use of that species. The reagents used in the Level II analysis actually detect the presence of specific immunoglobulins which are present in all body fluids (blood, sweat, and tears) and tissues (Newman 1990b), so that the term "blood residue test" is somewhat misleading.

Specific positive tests might reflect nothing more than the presence of animal urine, which might have been deposited on the surface of a stone tool without any human intervention.

The preservation of botanical material at an open Archaic campsite in the Middle Atlantic Coastal Plain is unusual, and there are no other Archaic site botanical assemblages from the Middle Atlantic region that are comparable to Indian Creek in terms of overall specimen frequency and species diversity. Flotation samples from the site contained 63 taxa representing a wide variety of fruit, tubers, starchy seeds, nuts, shoots, and leaves. Nearly all of the charred, native botanical specimens represent species of known ethnographic use.

Botanical data present a unique set of interpretive problems, and it does not necessarily follow that all charred seeds represent plants that were consumed or intentionally used by the site occupants (Holt in press; Keepax 1977; Minnis 1981:145; Moeller 1986; Smith 1985). Off-site control samples differed significantly from the on-site samples, both in terms of species representation, diversity, and overall specimen frequency, as measured by the number of charred seeds per unit of volume. Differences between the on-site and off-site samples, together with the fact that nearly all charred native specimens recovered from the site have documented ethnographic use, provide a convincing though not compelling argument that the Archaic hunter-gatherer groups that occupied the Indian Creek Site used a broad array of plant resources available in the floodplain and wetlands surrounding the site.

Plants that possess tubers account for more than four-fifths of the analytically significant botanical assemblage, and wetland habitats adjacent to the site would have provided an abundance of edible tubers and rootstocks. Tubers were important plant foods to the indigenous populations in the Eastern Woodlands, and they were usually boiled or roasted prior to consumption (Kavasch 1979; Keene 1981; Hamel and Chiltoskey 1975). Tuberous plants were available in early spring and late autumn, and some species were available throughout the year.

Edible greens also would have been abundant in streamside and wetland areas, and many of the tubers also possess edible greens as a constituent plant part. Edible greens tend to exhibit a scattered but dense distribution, but they would not have required a large amount of search time. The processing requirements for greens are minimal, consisting only of leaf stripping and cooking (Keene 1981).

Relative to other plant foods, starchy seeds have a high cost in terms of the labor required for processing. But while they require more effort for processing, seed-bearing weeds were a predictable and prolific resource that required minimal effort for acquisition. One important aspect of the starchy seeds is that they were most efficiently harvested after the first killing frost, when other plant foods would have been scarce (Hatch 1980; Keene 1981).

Fruit was an important food source not only for humans but also for animal populations. In addition to direct consumption of fruit, hunter-gatherer populations may have used the wetland and streamside habitats favored by fruit-bearing shrubs as favored localities for the taking of game.

Charred hickory nut and acorn often account for the majority of the botanical assemblage from hunter-gatherer sites in the eastern United States, but the preservation of nutshell in archaeological contexts may reflect taphonomic factors rather than its importance in the diet. Relative to other plant parts, nutshell is hard and dense, and these physical characteristics may have facilitated its preservation. The processing of nuts involves collecting, hulling, shelling, and preparation prior to consumption. There is a distinctive material culture associated with hunter-gatherer groups that depended heavily on the consumption of nutmeats, and the limited evidence of nutshell processing in the Middle Atlantic region may be related to the extraction of oil rather than nutmeat (Blume 1991). It is doubtful that nuts were an important dietary element for Middle Atlantic Archaic populations, but nuts were an important wildlife food, and the regional expansion of oak-hickory forests during certain periods of the Holocene would have permitted an increase in animal populations that in turn allowed expansion of human populations.

C. ENVIRONMENTAL ADAPTATION

Analysis of the site's environmental setting provides the most basic point of reference for a discussion of environmental adaptation. The site is located within a broad valley bottom associated with a minor tributary stream, and the Phase I survey of the 70-acre Greenbelt Yard project area indicated extensive use of the floodplain and terraces surrounding the site. Within that setting, the focus of occupation was a locus adjacent to three critical resources: water, lithic raw material, and a wetland environment. The site was located roughly 1,500 feet from the present stream channel, but immediately adjacent to a springhead which is now extinct. The site was also located adjacent to a gravel bar deposit, which provided a secondary source of quartz and quartzite cobbles.

The extensive wetland area that encompassed the Indian Creek floodplain appears to have been the most critical factor in the choice of the site location, given the marginal quality of the water source and the locally available lithic material. The extensive wetland area at the confluence of Indian Creek and Beaverdam Creek would have provided an attractive wildlife habitat, with numerous biotic resources useful to Archaic hunter-gatherer groups. The site's botanical assemblage provides evidence of the wide variety of tubers, fruit, greens, starchy seeds, and nuts. available in the immediate site area, and nearly all of the analytically significant botanical specimens have known ethnographic dietary and medicinal uses. The documented ethnographic use of the taxa represented in the botanical assemblage and the fact that many of the taxa favor floodplain or streamside habitats underscore the importance of wetland areas in the Archaic settlement pattern.

This study has also produced data that will enable refinement of existing regional models of Archaic adaptation, using the cultural ecology approach. A pollen core from a nearby abandoned stream channel has provided important information for reconstruction of the entire Holocene paleoenvironmental sequence. For more than 20 years, Carbone's (1976) research in the Shenandoah Valley has been the principal source of paleoenvironmental data for archaeologists working in the Middle Atlantic region. The DB-6 pollen core (Brush 1990) extracted during this study will provide an important new source of information for interpretation of regional prehistoric environments.

The suite of radiocarbon dates indicates that the core contains a virtually complete record of the local vegetational succession from the Late Glacial to the historic period. The Late Glacial vegetation in the Indian Creek vicinity, represented by Zone 1, was dominated by pine *(Pinus)* and spruce *(Picea)*, with alder becoming more abundant toward the end of the period. Among the nonarboreal plants, madder *(Rubiaceae)*, milkwort *(Polygala)* and composites *(Compositae)* were dominant. Cool, floodplain conditions are clearly indicated by the pollen record.

Zone 2 is marked by a major increase of birch *(Betula)* and a decrease of pine *(Pinus)* and spruce *(Picea)*, while alder *(Alnus)* decreases somewhat but remains plentiful. Oak *(Quercus)* increases in this zone but remains less plentiful than birch *(Betula)*. Goldenrod *(Solidago)* and arrowwood *(Viburnum)* are abundant among the non-arboreal taxa. Warming conditions are indicated by the increase of oak, and the abundance of goldenrod may be indicative of open areas within the local landscape.

The initial occupation of the site, represented by the Early Archaic Palmer/Kirk and bifurcated-base point groups, occurred within the early postglacial environment represented by Zone 2, which is dated circa 8800 to 5700 B.C. The expansion of birch forest seen in Zone 2 at Indian Creek generally parallels the regional Preboreal and Boreal episodes during the early Holocene.

Continued warming conditions are indicated by the pollen composition of Zone 3, dated circa 5700-3000 BC, and this zone also indicates much moister conditions. The reduction of pine and birch and the disappearance of spruce and fir *(Abies)* occur in this zone. Oak, hazelnut *(Corylus)* and alder are the dominant arboreal species, and maple *(Acer)*, black gum *(Nyssa)*, beech *(Fagus)*, ash *(Fraxinus)* and walnut *(Juglans)* are also present. Cinnamon-fern *(Osmunda)* is the dominant herbaceous species, and sedges *(Cyperaceae)* reach their peak in this zone. The warm, most conditions indicated by Zone 3 appear to correspond with the early part of the Atlantic climatic episode; however, the onset of the Atlantic episode is believed to have occurred circa 6500 BC (Carbone 1976; Custer 1984), somewhat earlier than the onset of Zone 3 conditions at Indian Creek.

Using data from the Delmarva peninsula, Custer (1986) has supported Gardner's argument that major changes in prehistoric lifeways occurred circa 6500 BC. Custer's data indicate a continuity in site locations for the period from 12,000 to 6000 BC, which suggests a continuity in settlement patterns, however the patterns of lithic resource use are not so uniform. In particular, there are significant changes in the lithic material preferences in Kirk Stemmed and bifurcated-base points, which date after circa 7500-7000 BC. Custer (1986:53) argues that the changes in lithic preference are associated with the onset of full Holocene environments, but provides no other evidence of significant cultural or environmental change at this time. Bifurcated-base points certainly represent a distinctive technology for the hafting of bifaces, but the introduction of this new technology is not associated with any apparent change in the settlement pattern. At the Indian Creek Site, bifurcated-base points and earlier Palmer/Kirk points were discarded in the same areas of the site, and there is no evidence of environmental change during the period from 8000 BC to 6000 BC.

The Middle Archaic abandonment of the Indian Creek Site appears to have coincided with the onset of the environmental conditions represented by Zone 3, suggesting that environmental change was a determinant factor in the site's occupational history. However, the coincidence of site abandonment and the onset of warm, moist climatic conditions is at odds with current models of cultural-environmental adaptation in the Middle Atlantic. At the regional scale, the warm, moist conditions of the Atlantic climatic episode are believed to have led to the formation and expansion of wetland habitats. Settlement pattern studies in the region show an expansion of Early Archaic components (represented by bifurcate-based points) into wetland areas that are variously described as interior swamps, freshwater marshes, ponds, bay/basin features and springheads (Custer 1984; Gardner 1987; Steponaitis 1980; Stewart 1989; Wanser 1982). The Indian Creek Site fits this model in the association of bifurcate based points with wetland habitats, but the results of this study differ from existing regional models in critical details. First, the DB-6 pollen core indicates that the onset of a warm, moist interval occurred later than the generally accepted beginning date of the Atlantic episode; second, the onset of warm, moist conditions marked the beginning of a period of decreasing rather than increasing site use.

The site's period of most intensive occupation appears to have occurred during the interval represented by Zone 4, judging from the number of Late Archaic points whose temporal range spans the 3000-2000 BC period. In Zone 4, oak continues as the the dominant arboreal species, and cinnamon-fern reaches its peak. Pine, hickory *(Carya)*, and walnut increase in this zone, while alder, birch, and hazelnut decrease. In addition to cinnamon-fern, abundant non-arboreal taxa include blueberry *(Ericaceae)* and elderberry *(Sambucus)*, while arrowwood and buckwheat *(Polygonaceae)* are present in moderate frequencies. The drier, mesic conditions of Zone 4 probably correspond to the mid-postglacial xerothermic conditions during the Subboreal climatic episode. The dominance of cinnamon-fern both in the pollen core and in the site's botanical assemblage suggests that the Late Archaic reoccupation and use of the site paralleled the expansion of a biotic environment characterized by high frequencies of fern.

Zone 5 in the DB-6 core indicates that significant change in the local environment occurred after circa 2000 BC (3860 BP). During the Zone 5 interval, the site chronology indicates a trend of decreasing intensity of occupation that culminated in final abandonment. There is no evidence of aboriginal use of the site after circa 1000 BC, the generally accepted date for the close of the Archaic period. Zone 5 is marked by a major reduction of arboreal pollen and an expansion of herbaceous species. Oak accounts for the majority of the arboreal pollen, but in significantly decreased frequencies. Major influxes of the bean family *(Leguminosae)* and elderberry, together with moderate increases in blueberry and arrowwood, mark Zone 5, which lasted until circa AD 200.

At the regional scale, Sub-Atlantic climatic conditions, characterized by the return of cooler, moister conditions, led to the reestablishment of mixed deciduous forests, beginning circa 800 BC. However, non-arboreal species continued to dominate the local environment in the Indian Creek vicinity until the historic period. Arboreal pollen remained at low levels in Zone 6, and many of the herbaceous taxa also disappeared. *Ericaceae* increased during this interval, possibly indicating the presence of heaths adapted to cool conditions. Cattail *(Typha)*, which is present exclusively in Zone 6, is also represented in moderate numbers. At Indian Creek, the Zone 6 conditions persisted until the European contact.

D. SETTLEMENT PATTERN

Eastern Archaic settlement patterns are generally characterized by seasonal movements through a series of habitats that provide various plant and animal foods at different times of the year. Different settlement types, distinguished by the group size and activities, were established during the annual round. In the Middle Atlantic region, Gardner (1981, 1989) and his associates have demonstrated that the Paleoindian settlement pattern was oriented primarily toward high quality cryptocrystalline lithic source areas, based on extensive research in the Virginia Valley and Ridge province and neighboring areas. Gardner's research suggests that the Paleoindian/Early Archaic focus on high-quality lithic sources gave way to a focus on seasonally available subsistence resources after circa 6500 BC (Gardner 1987:77). Using Gardner's framework, the initial occupation at the Indian Creek Site embodies this Paleoindian/Archaic shift in the settlement focus to seasonally available subsistence resources.

The initial occupation of the Indian Creek Site occurred during the Palmer and Kirk phases, which various investigators place in the Paleoindian or Early Archaic periods. Regardless of the chronological period to which one assigns the Palmer and Kirk phases, the presence of these points in the Indian Creek assemblage clearly indicates that exploitation of seasonally available resources began prior to 6500 BC Rhyolite was the favored material used in the Palmer and Kirk points discarded at the Indian Creek Site, and rhyolite is not available in the Coastal Plain. Although secondary lithic sources were available at the Indian Creek Site and at other loci throughout the Coastal Plain, it is unlikely that hunter-gatherer groups were attracted to the Indian Creek area primarily for the locally available quartz and quartzite cobble deposits. Instead, the Indian Creek Site vicinity would have been most attractive to hunter-gatherer groups because of its biotic resources.

Regional models (e.g., Custer 1984) of the Archaic settlement pattern generally recognize a limited range of site types, including base camps and procurement sites, with seasonal movement between different resource zones. Because of its location on a minor tributary stream and the limited variety of tools in the lithic assemblage (see Chapter VII), the Indian Creek Site would be classified by default as a procurement site, as it lacks the defining characteristics of a base camp. Archaic procurement sites are characterized by a limited range of activities, as inferred from a limited variety of discarded tool types, focused primarily on the exploitation of locally available resources (Custer 1984:67).

Both the lithic assemblage and the features are compatible with an interpretation of the site as a procurement station rather than a base camp. The site appears to have been a short-term habitation site that was frequently reoccupied during the Early Archaic and Late Archaic periods. The most common of the recognizable activities carried out at the site were chipped-stone tool production and the procurement and processing of foodstuffs. The large numbers of heavily resharpened and/or broken hafted bifaces indicate that much of the lithic reduction was geared toward refurbishing tool kits, specifically refitting projectiles with new points. These refurbishing tasks were apparently conducted in concert with exploitive and processing tasks, as represented by hafted bifaces, cobble tools, unifaces, modified flakes, and FCR. Neither the Early Archaic nor the Late Archaic occupations appear to have been of lengthy duration; rather, the lithic assemblage seems to indicate that the site was frequently reoccupied but for short periods of time. There is a limited variety of feature types at the site, and the features are representative only of cooking/heating and lithic reduction activities. Although various food processing methods such as dry roasting, container boiling, and steam pit cooking may have occurred, the feature inventory is overwhelmingly dominated by a single feature type. The limited variety of feature types within the site is perhaps an additional defining characteristic of the procurement site type.

Understanding of Middle Atlantic Archaic settlement patterns may be expanded by the use ethnographic analogy. Following Custer (1990), it is assumed that the Montagnais-Naskapi, who occupy the Eastern Subarctic region, provide the best modern analog for the Archaic groups that first used the Indian Creek Site circa 8000 BC. Fitzhugh (1972) has summarized the ethnographic literature of the Montagnais-Naskapi, focusing on the group's subsistence-settlement system. The Montagnais-Naskapi annual round is characterized by a high degree of seasonal variation, with many alternatives for each season. Bands average 50 to 100 individuals in size, and they usually consolidate once or twice a year, usually in the early spring or summer. Although there is much variation among bands and among extended families comprising a particular band, the general annual round is as follows. In the spring, bands typically coalesce at centrally located gathering sites at streamside or lakeside foci where feasting, marriage and other social activities take place. During the remainder of the year, extended family groups disperse to hunt. In summer, groups typically move to the coast or inland lakes to fish and hunt waterfowl, while caribou hunting in the interior forests is the mainstay of subsistence activity during the winter. Winter is the most severe time, and very little food is available. However, the cold months are most favorable for hunting, as caribou form herds during this period, but their migratory patterns require nearly constant movement between campsites (Fitzhugh 1972). Plant foods are most important to the Montagnais-Naskapi during spring and autumn. Plant foods, particularly berries, are most abundant during the spring, but fish, migratory birds, and large mammals emerging from hibernation are also taken at this time of year. Berries were also important during late summer and autumn when extended family groups occupy fishing camps or hunting camps (Fitzhugh 1972).

By analogy to the Montagnais-Naskapi subsistence-settlement system, the Indian Creek Site could be characterized as a gathering camp. The proximity to an extensive wetland area and the botanical assemblage suggest that the gathering of plant foods was an important subsistence activity at the site. The suite of biotic resources available in the adjacent wetland area would have included a broad variety of fauna (small and large game animals, waterfowl, fish, rodents, etc.) and plant resources. The excavated botanical assemblage included numerous taxa with documented ethnographic dietary and medicinal uses. The availability of plant resources in the site vicinity would have been greatest during the spring and fall; therefore, it is likely that the site was used most intensively during these seasons. Because of the spatial overlap of diagnostic points associated with the Early and Late Archaic periods and the limited variety of feature types within the site, it is believed that the site function was similar throughout its entire prehistoric occupational history.

E. TECHNOLOGY

Information pertaining to technology is available primarily from the analysis of the lithic assemblage. Lithic technology is expressed directly in the procurement patterns and the tool production technologies that may be identified as distinct industries.

The Middle Atlantic region encompasses a diversity of geological and biological environments that occur in linear zones from the Appalachian highlands to the Atlantic coast. These zones are crosscut by major drainages, such as the Potomac and the Susquehanna rivers, both of which terminate in the rich estuarine environments of the Chesapeake Bay. In Maryland, a wide assortment of igneous, metamorphic, and sedimentary rocks occur to the north and west of the Fall Line. Below the Fall Line, these bedrock units are buried by massive sequences of fine sediments and gravels. The absence of bedrock lithic sources in the Coastal Plain produced a situation in which the only available raw materials suitable for aboriginal tool production technology were redeposited cobbles and scattered deposits of ironstone.

The Indian Creek Site is located on a Pleistocene terrace of the Wicomico Formation (Matthews 1933) and adjacent to one of the many gravel bars found along the course of Indian Creek. It is likely that these gravel deposits, consisting primarily of quartz and quartzite, were one of the resources that attracted Archaic groups to this location.

Although the locally available material was limited primarily to secondary deposits of quartz and quartzite, the site's proximity to the Fall Line provided easy access to a greater array of lithic raw materials than would be the case if the site were located further into the Coastal Plain. Within a 6-mile (10-km) radius, both unconsolidated sand and gravel formations and igneous and metamorphic bedrock formations were potentially available to aboriginal populations. The igneous and metamorphic bedrock materials include granite, gabbro, schist, gneiss, and quartzite. An even greater assortment of raw materials is contained within formations exposed further into the Piedmont. In the District of Columbia, about 6 miles (10 km) southwest of the site, there were extensive quarries and workshops focused on the extraction of quartzite and steatite, and similar quarries and workshops are known to occur along the Fall Line in adjacent areas of Maryland. At these locations, quartzite is known to occur as large cobbles and boulders.

Five raw materials account for almost all (99 percent) of the lithic assemblage: quartz, quartzite, ironstone, rhyolite, and sandy chert. Quartz, quartzite, and ironstone are the three most common materials and are present in nearly equal proportions, while considerably lesser amounts of rhyolite and sandy chert were recovered. All of the remaining raw materials account for less than one percent of the assemblage. The dominance of quartz, quartzite, and ironstone can easily be explained by their local availability, particularly quartz and quartzite, as deposits of these materials are directly adjacent to the site. An important difference between these materials is how they were used at the site. Quartz and quartzite were used in cooking/heating facilities (resulting in FCR) and were shaped into a wide assortment of tools and resultant debris, while ironstone was used almost exclusively in cooking/heating facilities.

The chipped-stone assemblage is dominated by four raw materials: quartz, quartzite, rhyolite, and sandy chert. The popularity of rhyolite (metarhyolite) is somewhat unexpected because it is not locally available. The likely source of this material is the South Mountain area of northern Maryland and southern Pennsylvania. The presence of rhyolite at the site could be the result of several different procurement strategies: (1) direct procurement, perhaps linked to seasonal movements between the highlands and the Coastal Plain; (2) indirect procurement, i.e., exchange networks; or (3) direct procurement from redeposited sources. The redeposition hypothesis may be rejected, because significant amounts of rhyolite are not known to occur in the Coastal Plain and because of the lack of cobble cortex on any of the rhyolite artifacts. Instead, it is apparent that rhyolite artifacts arrived at the site in finished or nearly finished form, with some artifacts retaining areas of block cortex.

The low proportion of sandy chert artifacts with cortex indicates that this material may be nonlocal, but the character of the cortex does not support this interpretation. Every specimen exhibits cobble cortex; hence, sandy chert appears to be a redeposited material that may have been locally available. The same conclusions are directly applicable to the chert and chalcedony artifacts because cortex is not common, but when it is present, it is cobble cortex. The cortex present on jasper artifacts is consistently block cortex, thus indicating a nonlocal source for this material. No cortex was observed on argillite artifacts, and although cortex is often difficult to identify on argillite artifacts, it is likely that the argillite artifacts in the assemblage reached the site in finished form from a distant source. Analysis indicates that only three of the raw materials used in chipped-stone tool production were not available or potentially available in the Coastal Plain: rhyolite, jasper, and argillite.

The number of artifacts manufactured from argillite and jasper is small, and thus provides little data with which to evaluate procurement strategies. Rhyolite, on the other hand, was an important resource, and its procurement is examined within a temporal framework by using hafted biface data. In the Early Archaic, rhyolite was the dominant raw material, particularly among bifaces of the Palmer/Kirk group. The use of chert in biface production is restricted to this time period as well. The use of rhyolite for biface production continued into the Late Archaic, but its importance was greatly reduced. Through time (i.e., Early Archaic to Late Archaic), there is a pattern of increasing reliance upon locally available materials (quartz and quartzite) at the expense of rhyolite. This trend conforms to the traditional interpretations of the Late Archaic as a period of reduced settlement mobility and more restricted group territories relative to the Early Archaic, which may be viewed as a period of greater mobility, with seasonal rounds apparently including the South Mountain area and the Coastal Plain.

The lithic assemblage from the Indian Creek Site can be divided into two general industries, a chipped-stone and a groundstone industry. Within the chipped-stone industry, three separate, more specific industries can be identified: a biface industry, a formal flake-tool industry, and an informal flake-tool industry.

The biface industry is the most common, represented by hafted bifaces, unfinished bifaces, drills, and indeterminate biface fragments. The unfinished (i.e., early-stage, middle-stage, and late-stage) bifaces are believed to be hafted bifaces that were not completed because they were either rejected for some reason (e.g., breakage or severe hinge fractures) or the production process was halted so they could be stored (cached) and completed at a later date. One clear example of the caching of unfinished bifaces, Feature 29, was discovered during excavation. However, it is apparent that some bifaces in all stages of production were either used to perform other tasks after rejection or they were manufactured specifically for these tasks and do not represent unfinished hafted bifaces.

The great majority of the unfinished bifaces were manufactured from locally available raw materials (quartz, quartzite, ironstone, and sandy chert), and it is clear that biface production at the site was primarily based upon locally available materials. But some unfinished rhyolite bifaces arrived at the site, apparently in nearly finished form; most of these were bifacial preforms/cores that were probably carried to the site by Early Archaic groups.

The formal flake-tool industry is represented by endscrapers and sidescrapers, although these tools may have had multiple functions. They were probably hafted and designed to be reused; most were manufactured from quartz and quartzite, but one is made from rhyolite and five are made from chert. The chert specimens are probably Early Archaic but the others may be Early Archaic or Late Archaic. The paucity of formal flake tools suggests that tasks which required formalized flake tools were not widely conducted at the site.

The informal flake-tool industry is represented by expedient flake tools (modified flakes) and cores. The flake tools are, for the most part, flakes that have been detached from cores and used without further modification for various cutting and scraping tasks. Due to the difficulty of recognizing use wear, the actual number of flakes that were used as tools is probably much higher than identified. Quartz and quartzite are the most common raw materials, followed by rhyolite, sandy chert, chert, and chalcedony. Several of the rhyolite tools are clearly flakes that were detached from bifaces.

Three types of cores were identified: tested cobbles, polymorphic cores, and bipolar cores. Tested cobbles may or may not be related to flake-tool production. They are merely cobbles that had one to three flakes removed to inspect the suitability of the cobble, but they were not further reduced. Polymorphic (freehand) cores are cobbles that have had flakes detached in multiple directions; platforms were selected opportunistically and preparation of platforms appears to have been minimal. Quartz and quartzite are the dominant raw materials, but there are also a few rhyolite specimens, most of which appear to be extensively reworked bifaces. Bipolar cores are cobbles or pebbles that have had flakes detached by direct hard-hammer percussion on an anvil. Quartz accounts for the great majority of the bipolar cores, followed by chert. Bipolar cores are normally smaller than polymorphic cores because bipolar reduction is a technique for maximizing available raw materials. Most flakes and shatter generated by this technique are suitable only for expedient flake tools. The production of simple flake tools is well represented in the assemblage, and their production was centered on quartz and quartzite cobbles. However, the popularity of quartz and chert in bipolar reduction is directly linked to their fine-grained isotropic structure, which permits detachment of small flakes with clean, sharp, straight edges.

Flakes and chunks cannot be assigned to any single industry. They are general by-products of chipped-stone tool production, and they constitute more than half of the assemblage. They are by-products of both biface reduction and flake-tool production, and it is notable that most of the rhyolite flakes are biface-thinning and edge-maintenance flakes. For quartz and quartzite, the complete biface reduction sequence appears to be represented, given the distribution of cortex and flake sizes.

The overall groundstone industry can be divided into an informal groundstone industry and a formal groundstone industry. The informal groundstone industry encompasses the expedient use of local cobbles and ironstone for tools and for cooking/heating facilities (i.e., FCR). The technology is simple, consisting only of the collection of locally available lithic materials for use in various tasks, followed by discard or abandonment.

The formal groundstone industry is represented only by a few fragmentary artifacts. These include a few tiny fragments of serpentine with polished exteriors that could have been bannerstones, pendants, or possibly axes. One or two steatite vessels are also represented, and pigment production appears to be represented at the site by chunks of limonite with ground and striated surfaces. There is also a chunk of schist that has been shaped by flaking, pecking, and grinding. Except for the chunk of schist, there is no clear evidence of formal groundstone tool production at the site, and the number of formal groundstone tools represented by these modest fragments is minimal.

F. INTRASITE ACTIVITY ORGANIZATION

The Indian Creek Site has been interpreted as a periodically revisited gathering camp/procurement site at which a limited variety of extractive and maintenance tasks were carried out. These activities included food processing, consumption, discard of waste, and tool manufacture and maintenance. Although these activities may be inferred individually on the basis of excavated features, tools, and waste material, the arrangement of these activities within the site is the focus of activity-area reconstruction.

At the Indian Creek Site, the FCR features have been interpreted as cooking areas located within the site's primary habitation area, and these features are assumed to represent relatively permanent facilities that remained in their original use location. Based on that assumption, the features were used as points of reference for analysis of the distributional patterning of lithic tools and debris. It is assumed that tools may have been reused during the site's occupation and that refuse may have been redeposited in an effort to maintain cleanliness within the habitation area. Although the intrasite distribution of tools and debitage is assumed to provide a relatively accurate representation of the location of discard activities, it should be understood that use locations may differ from discard locations.

While there was only limited evidence of vertical stratigraphy, clustering and concentration of specific tools and raw materials were in many cases readily apparent, indicating the presence of horizontally well-defined activity areas. Given the site's shallow depth and the lengthy period of aboriginal use by hunter-gatherer groups, there is no doubt that many different activities were carried out within the same relatively restricted space. As a whole, the site contained a palimpsest of deposits associated with numerous discrete occupational episodes. Nonetheless, analysis of the distribution of lithic tools and specific raw materials has permitted recognition of a number of discrete activity areas within the site.

The internal site patterning is evident from various perspectives. First, there were many examples of individual point types and debitage concentrations in locations immediately adjacent to FCR features, indicating that these cooking areas were the focal points for activities within the site's primary habitation area. Also, the clustering of diagnostic point types indicates that in many cases individual occupational phases or episodes occurred within fairly restricted areas of the site.

The Early Archaic occupations, represented by the Palmer/Kirk and bifurcated-base point clusters, were concentrated in localized areas of the site's primary habitation area. The clustering of the Early Archaic points indicates that these occupational episodes generally occurred within the same areas of the site.

Late Archaic points are more numerous and widely distributed than the Early Archaic points, and the degree to which individual Late Archaic point types exhibit spatial patterning is not uniform. Many of the Late Archaic points, including the Morrow Mountain, Brewerton/Otter Creek, Lackawaxen, Calvert, Clagett and small Savannah River types are dispersed throughout the site. Others, such as the large Savannah River, Holmes, and Vernon/Halifax types are more concentrated, although apparent concentrations of the latter type may simply reflect its high frequency. At a general level, the spatial dispersal of the Late Archaic points throughout the site is distinct from the clustering of the Early Archaic points, and it suggests occupation by larger groups composed of several distinct social units, such as households or extended families.

Activity areas within the site are most apparent in the concentrations of debitage and clusters of tools. Locally available lithic materials, particularly quartz and quartzite, exhibit a ubiquitous distribution, and they were exploited during both Early and Late Archaic occupations. There are a number of distinct activity areas associated with locally available lithic materials, and these are indicative of distinctive behavioral patterns related to lithic procurement and manufacturing activities, in addition to more generalized processing tasks.

The staging and spatial separation of the reduction of local lithic material are most clearly evident in the distribution of quartzite tools and debitage, and it is believed that the use of quartzite was most intensive during the Late Archaic period, particularly during the occupations represented by Savannah River and Holmes points. The full production sequence is represented at the site, including the extraction and initial testing of cobbles and the reduction of cores into finished bifacial implements. Cobbles were extracted and tested at the gravel bar at the northern margin of the site, and a cache of unfinished quartzite bifaces was located within the site's primary habitation area. The largest concentration of quartzite debitage was at the western margin of the site, apparently isolated from the primary cooking and habitation areas. This pattern suggests that a greater degree of specialization in the use of space had occurred by the Late Archaic, with a conscious effort to segregate activities that produced a large amount of debris from the site's principal habitation area.

The distributional patterning of nonlocal lithic material is in some cases clearer than that of locally available material, perhaps because the assemblage contains less nonlocal material and its use was in some cases limited to single occupational episodes or phases. Rhyolite, the most common nonlocal lithic material in the assemblage, was used during both the Early and Late Archaic occupations. The initial procurement of rhyolite did not occur at or near the site, but the entire biface reduction is represented by cores, unfinished bifaces, biface fragments, and debitage. Rhyolite debitage is most concentrated in the site's primary habitation area, and the locations of several discrete debitage concentrations suggest that tool production or rejuvenation were among the activities carried out in the central living area.

The spatial distribution of sandy chert is the most well defined of any material in the assemblage. This material may have been deposited during a single occupational episode, judging from its limited distribution and its use in a single diagnostic point type. Only one diagnostic artifact, a Morrow Mountain point, was made of this material, and it dates to the beginning of the site's Late Archaic period of use. The sandy chert debitage is concentrated in an area adjacent to but not overlapping the site's principal habitation area, as defined by the concentration of FCR features.

Other nonlocal materials (chert, jasper, chalcedony, and argillite) account for only a minor fraction of the total assemblage, and their use was probably limited to relatively few occupational episodes or single phases. In some cases where spatial patterning of these materials was apparent, concentrations of tools and debitage were identified adjacent to FCR features. Examples include a concentration of jasper adjacent to Feature 3 and a concentration of chalcedony adjacent to Features 7, 8, and 9. These examples suggest the maintenance or resharpening of tools made of nonlocal material within the site's central habitation area.

G. RESOURCE TREATMENT CONSIDERATIONS

The research design for archaeological data recovery was structured to address the research priorities outlined in Maryland's Comprehensive Historic Preservation Plan (HPP). Maryland's HPP (Maryland Historical Trust 1986:251-258) provides an explicit statement of current information needs, organized according to the state's major physical regions and time/developmental periods. This document, developed according to the Department of the Interior's Resource Protection Planning Process (RP3) model, defines a number of themes or information needs which may be used as an interpretive framework or context for data collection and analysis. The themes outlined for the prehistoric period are quite general in scope, and are not developed in detail. While the HPP themes are expressed in general terms, use of the HPP did provide a suitable framework to develop an explicit statement of the site's significance and ultimately allowed integration of site-specific research results into a broad regional context. It is recommended, however, that future iterations of the state preservation plan be updated to reflect the results of recent and ongoing research.

The overall process of cultural resource management proceeds through three stages: identification, evaluation, and treatment. At the Greenbelt Yard METRO railcar storage and maintenance project, WMATA has completed the entire three-stage process, having sponsored archaeological survey, testing, and excavation studies. WMATA initiated the consultation process with the Maryland

SHPO in 1986, well in advance of the anticipated project construction date of 1993. Throughout the entire program, WMATA maintained close coordination with the Maryland SHPO and other regulatory agencies, completely fulfilling their obligation to consider the effects of construction on archaeological resources. WMATA is governed by an elected board of directors, and the scheduling of construction activities is to some extent influenced by local politics. To the credit of WMATA's technical staff, the identification and evaluation process was initiated early enough so that an acceleration in the construction schedule mandated by the board of directors was accommodated with no adverse effect to archaeological resources or compromise to the Section 106 compliance process.

In addition to management issues, it is appropriate to examine the identification, evaluation, and treatment of archaeological resources from a technical perspective. In this regard, questions pertinent to field sampling, data recovery, and analysis should be addressed.

Prehistoric sites had been previously identified in the Greenbelt Yard project area and the surrounding area, and the initial archaeological survey involved a combination of surface inspection and shovel testing techniques. Area 3 of the Indian Creek Site, which was ultimately determined eligible for the National Register and subjected to a program of data recovery, was initially identified by shovel testing at 75-foot intervals. Additional Phase I fieldwork involved more intensive shovel testing, at 15-foot intervals, and small (3x3-foot), scattered test units. The 15-foot shovel testing effectively identified the site's principal habitation areas, as determined later during the Phase II testing and Phase III block excavations.

While the overall field sampling design has apparently fulfilled all of the project's management and technical objectives, execution of the survey, testing, and data recovery fieldwork at different seasons of the year has apparently produced some statistical anomalies in the database. This problem, described in Chapter VIII, centers on the recovery of microdebitage. To a large extent, however, this problem is inherent in the sequential staging of survey, testing, and data recovery fieldwork.

The integration of flotation recovery techniques into the project during the site evaluation stage (Phase II) has been extremely valuable. While the issues surrounding prehistoric utilization of plant resources are complex, flotation recovery techniques have produced some of this study's most stimulating results. The association of charred botanical specimens in association with prehistoric sites does not necessarily imply intentional aboriginal use of specific taxa, but at the very least, the botanical assemblage allows detailed reconstruction of the site's biotic environment. Flotation recovery is becoming more widely used in archaeological fieldwork, but there is still a need for closer integration of paleobotanical studies into archaeological research designs.

Analysis of the residues on stone tools is a technique that is becoming more widely used but which is not well understood. The two-stage program that was carried out for the Indian Creek Site produced interesting results and also called attention to the limitations of the technique. While the taxa represented generally conformed to accepted models of Archaic subsistence patterns, the relative lack of positive results on formalized tools suggested either that there was a much greater reliance on an expedient tool technology or that some of the positive residues did not result from direct cultural activity. It is recommended that future research be structured specifically to address this issue.

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